

A Revision of the *Bavayia validiclavis* group (Squamata: Gekkota: Diplodactylidae), a Clade of New Caledonian Geckos Exhibiting Microendemism

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The genus *Bavayia* as currently construed is paraphyletic relative to other New Caledonian diplodactylid geckos. *Bavayia validiclavis*, from the Massif du Panié in northeastern New Caledonia, is a relatively basal member of the entire New Caledonian diplodactylid radiation and is here recognized as the type species of a new genus characterized by small size and a unique combination of digital and coloration features. Recent surveys of the ultramafic massifs of northwestern New Caledonia have revealed seven additional species assignable to this genus. The new species are morphologically conservative but genetically distinctive from one another. Allopatric species occur on the Massif de Koniambo, Mt. Taom, Kaala, the Dôme de Tiébaghi and the adjacent Rivière Néhoulé, and on the Îles Belep and Île Yandé, off the northern coast of the New Caledonian mainland. Two new species occur sympatrically on Sommet Poom, the northernmost of the mainland ultramafic massifs. Sequence data from the mitochondrial ND2 gene and the nuclear RAG-1 gene yield a single, well-supported phylogenetic hypothesis for the genus and suggest a time of 18.6–19.2 million years to common ancestry. The most recent speciation events in the genus are estimated to have occurred 5.7–10.1 million years ago. Cladogenesis within the genus may be associated with the erosion and fragmentation of ultramafic substrates and/or with climatic and vegetational changes in the region. Because of their very limited distributions, all of the new species are considered to be Endangered or Critically Endangered.

KEY WORDS: Gekkota, Diplodactylidae, *Bavayia*, *Dierogecko* gen. nov., species description, New Caledonia, molecular phylogeny, biogeography, conservation

The genus *Bavayia* was erected by Roux (1913) to accommodate two species (and three non-nominate subspecies) of New Caledonian geckos previously assigned to the widespread Pacific genus *Lepidodactylus*. *Bavayia*, along with two other endemic New Caledonian gecko genera, *Rhacodactylus* and *Eurydactylodes*, was subsequently referred to the endemic southwestern Pacific gekkotan subfamily Diplodactylinae (Underwood 1954, 1955; Kluge 1967, 1987; Russell and Bauer 2002), which has since been elevated to familial status (Good et al. 1997; Han et al. 2004). No taxonomic work on *Bavayia* was carried out for more than 70 years following the work of Roux (1913), but since the late 1980s, a series of contributions have raised Roux's subspecies to full

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species (Sadlier 1989) and have identified seven additional taxa: *B. septuiclavis*, *B. validiclavis*, *B. pulchella*, *B. exsuccida*, *B. geitaina*, *B. robusta*, and *B. madjo* (Sadlier 1989; Bauer et al. 1998; Wright et al. 2000; Bauer et al. 2000). Previous phylogenetic analyses within the genus (Bauer 1990; Wright 1999) recognized two major intrageneric groupings, corresponding to the *B. cyclura* and *B. sauvagii* groups, diagnosable from one another on the basis of differences in digital morphology. Although some of the more recently described forms were referable to these groups (*B. pulchella*, *B. exsuccida*, *B. geitaina* in the *B. sauvagii* group and *B. robusta* in the *B. cyclura* group), the other taxa could not be so allocated and their affinities remained uncertain.

As part of ongoing studies of the New Caledonian herpetofauna, and especially in association with herpetofaunal surveys (2001–2002) of the Province Nord (Whitaker et al. 2004), we obtained *Bavayia* spp. from numerous, previously unsampled localities throughout northern New Caledonia. This material has been studied using traditional morphological methods and through DNA sequencing. Initial results demonstrate that species diversity within *Bavayia* is much greater than previously appreciated. In particular, a number of new taxa have been discovered that are both similar in appearance and closely related to *B. validiclavis*.

Bavayia validiclavis was described by Sadlier (1989) on the basis of material from Mt. Panié. Until 2000 the only known areas of occurrence of this species were Mt. Panié and Mt. Mandjélia, two peaks in the northeast part of New Caledonia. It is a small species (to 45 mm SVL) and usually has a broad light brown to tan vertebral stripe covering most of the dorsal surface (although this is lacking in some specimens in which the dorsum is plain or has a series of light dashes along the dorsolateral margins). In addition, the claw of the first digit is offset and positioned asymmetrically within a groove in the apical lamella (a condition similar to that of the *B. cyclura* group), and males possess preanal pores in two rows, 12–16 anteriorly and 8–11 posteriorly. All new members of the *B. validiclavis* group share some of these features and may be collectively diagnosed from remaining *Bavayia* by them. In this paper we describe seven new species in this group and present a molecular phylogeny of this clade of northern New Caledonian endemic geckos.

A broad-scale phylogenetic analysis of all New Caledonian geckos (Bauer et al. 2004; Jackman et al. 2004; Jackman 2005) reveals that *Bavayia* as presently construed is paraphyletic, with the other endemic New Caledonian diplodactylids, *Rhacodactylus* and *Eurydactylodes*, being derived from within it. In order to retain only monophyletic genera we propose to recognize several genera within *Bavayia* sensu lato. The *B. validiclavis* group is a relatively basal member of the New Caledonian diplodactylid clade and is described herein as a new genus. This action causes minimal disruption to the established usage of generic names as the combination *Bavayia validiclavis* has received relatively little use, being applied only in the limited systematic literature dealing specifically with New Caledonian reptiles (see Bauer and Sadlier 2000).

MATERIAL AND METHODS

MORPHOLOGY.—The following measurements (to the nearest 0.1 mm) were taken with DigiCal digital calipers: snout-vent length (SVL; from tip of snout to vent), trunk length (TrunkL; distance from axilla to groin measured from posterior edge of forelimb insertion to anterior edge of hindlimb insertion), crus length (CrusL; from base of heel to knee); tail length (TailL; from vent to tip of tail), tail width (TailW; measured at widest point of tail); head length (HeadL; distance between retroarticular process of jaw and snout-tip), head width (HeadW; maximum width of head), head height (HeadH; maximum height of head, from occiput to underside of jaws), ear length (EarL; longest dimension of ear); forearm length (ForeaL; from base of palm to elbow); orbital diameter (OrbD; greatest diameter of orbit), nares to eye distance (NarEye; distance between ante-

riormost point of eye and nostril), snout to eye distance (SnEye; distance between anteriormost point of eye and tip of snout), eye to ear distance (EyeEar; distance from anterior edge of ear opening to posterior corner of eye), internarial distance (Internar; distance between nares), and interorbital distance (Interorb; shortest distance between left and right supraciliary scale rows). Measurements and scale counts based on right side of animals unless otherwise noted.

Scale counts and external observations of morphology were made using a Nikon SMZ10 stereo dissecting microscope. Radiographs were prepared using a Faxitron closed cabinet x-ray unit. Specimens were x-rayed at 25–30 kV for 25–30 sec and imaged on Polaroid type 72 film. Photographs of preserved specimens were taken with a Nikon Coolpix 990 digital camera.

Comparisons were made with museum material in the collections of the California Academy of Sciences (CAS), the Australian Museum (AMS), and the Muséum National d'Histoire Naturelle, Paris (MNHN). Other collections mentioned are the Museum of Comparative Zoology, Harvard University (MCZ), Queensland Museum (QM), United States National Museum (USNM), and Yale Peabody Museum of Natural History (YPM).

MOLECULAR METHODS.— Genomic DNA was extracted using the Qiagen QIAmp tissue kit. PCR amplification was conducted under a variety of thermocycler parameters using a variety of primers (Table 1). Products were visualized via 1.5% agarose gel electrophoresis. Amplified products were purified either using AmPure magnetic bead PCR purification kit or reamplified products were purified on 2.5% acrylamide gels (Maniatis et al. 1982) after being reamplified from 2.5% low melt agarose plugs. DNA from acrylamide gels was eluted from the acrylamide passively over two days with Maniatis elution buffer (Maniatis et al. 1982).

Cycle-sequencing reactions were performed using the Applied Biosystems BigDye™ primer cycle sequencing ready reaction kit. The resulting products were purified using SeqClean magnetic bead purification kit. Purified sequencing reactions were analyzed on an ABI 3700 automated sequencer. To insure accuracy, negative controls were included in every reaction, complementary strands were sequenced, and sequences were manually aligned by eye using the original chromatograph data in the program SeqMan II. Sequences from all specimens of ingroup taxa sampled (Table 2) are available through GenBank

PHYLOGENETIC ANALYSES.— Phylogenetic trees were estimated using parsimony, likelihood and Bayesian analysis. PAUP* 4.0b10a (Swofford 2002) was used to estimate parsimony and likelihood trees. Parsimony searches were conducted with 100 heuristic searches using random addition of sequences. Non-parametric bootstrap resampling was used to assess support for individual nodes using 1000 bootstrap replicates with ten random addition searches. For maximum likelihood analyses, ModelTest version 3.5 (Posada and Crandall 1998) was used to compare different models of sequence evolution with respect to the data. The chosen model was used to estimate parameters on the most parsimonious tree. These likelihood parameters were fixed and the most parsimonious trees were used as starting trees for branch swapping in 25 heuristic searches with random addition of taxa to find the overall best likelihood topology. To estimate a phylogenetic tree with a Bayesian framework MrBayes 3.0 (Huelsenbeck and Ronquist 2001) was used with the model chosen using ModelTest 3.5. The Bayesian analyses were initiated from random starting trees and run for 2,000,000 generations with four incrementally heated Markov chains. Likelihood parameter values were estimated from the data and initiated using flat priors. Trees were sampled every 100 generations, resulting in 20,000 saved trees. To ensure that Bayesian analyses reach stationarity, the first 5000 saved trees were discarded as 'burn-in' samples.

SPECIES DELIMITATION.— There has been much recent interest in the topic of species delimitation and its relationship to species concepts (Wiens and Servedio 2000; Brown and Diesmos 2001; Wiens and Penkrot 2002; Ferguson 2002; Hebert et al. 2003; Sites and Marshall 2003, 2004;

Blaxter 2004; Watson 2005). In this paper we follow a lineage-based species concept (Mayden 1997; de Queiroz 1998), but from a practical viewpoint, we are chiefly concerned with the properties that such lineages express that permit us to infer species boundaries (Otte and Endler 1989; Ereshefsky 1992; Howard and Berlocher 1998; Watson 2005). A variety of operational criteria for diagnosing species boundaries have been proposed (Sites and Marshall 2003, 2004). Wiens and Penkrot (2002) compared tree based approaches to species delimitation based on DNA data and both tree-based and character-based approaches based on morphological data. Although numerous studies have found congruence between character- and mtDNA tree-based approaches with respect to species boundaries (e.g., Hollingsworth 1998), Wiens and Penkrot (2002) found significant discordance in their analysis of *Sceloporus*. In such cases they favored the species limits suggested by mtDNA data, arguing that some taxa exhibit high levels of within species phenotypic variation and relatively low between species differentiation and that such circumstances represented a “worst-case scenario” for morphologically based species delimitation. In these cases haplotype differentiation may occur faster than change in diagnostic morphological characters, providing a more accurate picture of lineage boundaries.

The new genus described herein consists of putative taxa that differ very little with respect to most morphological characters. While, for pragmatic reasons, we would prefer to have a diversity of unambiguously diagnostic morphological features to support the recognition of each of the species level taxa we present herein, we accept that any data that identify independent lineages may be appropriately used in species delimitation. We have analyzed DNA sequence and character-based species delimitations in light of each other. Subtle differences revealed by coloration and a few morphological features were in all cases corroborated by strong support from the gene trees. Although distribution patterns were not used in erecting our hypotheses of species boundaries, we considered geographic concordance (as reflected by allopatry) with both the tree- and character-based species limits as indicative of lineage independence and, thus, supportive of our taxonomic decisions. Bergmann and Russell (2006) adopted a rather similar approach to the identification of species boundaries in the widespread Neotropical gecko *Thecadactylus*.

SYSTEMATICS

Generic status of the *Bavayia validiclavis* group

Wright (1999) was the first to explicitly consider the phylogenetic position of *Bavayia validiclavis* in her allozyme-based analysis of the genus. She found *B. validiclavis* to form an unresolved trichotomy with other *Bavayia* and with *Rhacodactylus*. Thus, the distinctiveness of this taxon has been suspected for some time. As part of our molecular phylogenetic study of all New Caledonian lizards we included *B. validiclavis* as well as representatives of numerous isolated populations of *validiclavis*-like geckos collected chiefly in association with herpetofaunal surveys of the ultramafic peaks of the Province Nord (Whitaker et al. 2004).

On the basis of sequence data from the mitochondrial gene ND2 and the nuclear RAG-1 gene, we identified eight putative taxa among the *validiclavis*-like geckos studied. Together these form a well supported monophyletic group (posterior probability = 1.0; bootstrap = 100%) distinct from all other New Caledonian diplodactylids. The position of this group relative to other monophyletic units, however, is equivocal. In all analyses the group is retrieved in a basal polytomy with *Bavayia madjo*, all other *Bavayia*, and *Rhacodactylus* + *Eurydactylodes*, or it is very weakly supported as the sister group to all of these clades combined. There is no evidence that the *validiclavis* group is either embedded within *Bavayia* or the sister group to all other *Bavayia* exclusive of *Rhacodactylus* and *Eurydactylodes*.

As retention of the *validiclavis* group within *Bavayia* would render this genus paraphyletic, we recognize *B. validiclavis* and its close relatives as representatives of a new genus, *Dierogekko*, here proposed. As the only previously named species of this genus was described rather recently (Sadler 1989), refers to a highly geographically restricted form, and has not been cited frequently in the literature (see Bauer and Sadler 2000), this action may be accomplished with minimal disruption to familiar usage of the existing generic name *Bavayia*.

Reptilia: Squamata: Diplodactylidae

Dierogekko Bauer, Jackman, Sadler, and Whitaker, gen. nov.

TYPE SPECIES: *Dierogekko validiclavis* (Sadler, 1989).

ETYMOLOGY.— Derived from the Greek *dieros*, meaning active or nimble and the Malay *gekko*. The name is masculine and refers to the nimble movements of members of this genus when foraging on vegetation at night.

DIAGNOSIS.— *Dierogekko*, gen. nov. can be distinguished from all other diplodactylid geckos by the following combination of character states: body size small (< 46 mm SVL); dorsal scalation granular, homogeneous; body without extensive skin webs or flaps; expanded subdigital lamellae under all toes; lamellae under penultimate phalanx of digits II–V of manus and pes paired or single; claw of digit I of manus and pes in a groove in the apical lamella between a larger medial scansor and a smaller lateral scansor; one or two (rarely three) internasal scales separating supranasal scales; lining of mouth unpigmented; dorsal pattern of longitudinal lines or series of spots or patternless, never with transverse markings; venter usually cream to light brown, sometimes pale yellow, never bright yellow.

Members of the genus *Dierogekko* superficially resemble members of the genera *Bavayia* and *Oedodera*, all of which are relatively small and predominantly brown in color. They differ from the recently described *Oedodera* (Bauer et al. 2006) in possessing divided distal subdigital lamellae (except *D. poumensis*) and in lacking a swollen neck and medial apical scansors on digit II of the pes. *Dierogekko* spp. may be distinguished from *Bavayia sauvagii*, *B. ornata*, and *B. madjo* by the position of the claw of digit I of manus and pes (in a groove between medial and lateral portions of a cleft apical scansor vs. lateral to a single medial apical scansor), from *B. cyclura*, *B. montana*, *B. crassicollis*, *B. robusta*, *B. geitaina*, and *B. exsuccida* by the absence of transverse dorsal markings and by much smaller body size (< 50 mm vs. > 72 mm max. SVL) in all but the last of these species, and from *B. pulchella* and *B. septuiclavis* in having the entire dorsal surface lighter than the flanks and demarcated by a series of narrow, continuous or broken stripes (vs. a narrow pale vertebral stripe and/or no white border stripe).

DISTRIBUTION.— *Dierogekko* is restricted to the northernmost areas of New Caledonia, from Île Pott in the Îles Belep, north of the Grande Terre (the main island of New Caledonia), to Mount Koniambo on the central west coast. On the east coast, the group reaches an apparent southern limit at Mt. Panié. All localities for species of *Dierogekko* lie within the Province Nord of New Caledonia.

RECOGNIZED SPECIES.— *Dierogekko validiclavis* (Sadler, 1989), *D. thomaswhitei*, sp. nov., *D. poumensis*, sp. nov., *D. insularis*, sp. nov., *D. nehoueensis*, sp. nov., *D. kaalaensis*, sp. nov., *D. koui-ambo*, sp. nov., and *D. inexpectatus*, sp. nov.

Dierogecko validiclavis (Sadlier, 1989)

Figures 1–2.

TYPE MATERIAL.— **HOLOTYPE:** Australian Museum (AMS) R77855, adult male, Mt. Panié (500–600 m elevation), Province Nord, New Caledonia, 20°33'S, 164°45'E [published coordinates], 20°33'43"S, 164°46'50"E [corrected coordinates], collected by R.A. Sadlier and P.R. Rankin, 17 December 1978. **PARATYPES:** AMS R77847, 77853–54, 77856–58, 77895, 78353, same data as holotype; Queensland Museum (QM) J43980, Mandjélia near Pouébo, Province Nord, New Caledonia, 20°23'S, 164°33'E; Muséum National d'Histoire Naturelle, Paris (MNHN) 1980.1067, Mt. Panié, Province Nord, New Caledonia.

ADDITIONAL MATERIAL.— AMS R144229–30, 149305, 149314, 149367–68, Mt. Panié, Province Nord, New Caledonia, 20°33'35"S, 164°47'03"E; AMS R 146350, CAS 198703–04, Mt. Mandjélia, Province Nord, New Caledonia, 20°24'15"S, 164°31'18"E; AMS R 153695–99, Mt. Mandjélia, Province Nord, New Caledonia, 20°24'17"S, 164°31'06"E.

DIAGNOSIS.— *Dierogecko validiclavis* can be distinguished from all its congeners on the basis of the following combination of characters: size relatively large (to 45.0 mm), one (rarely two) internasal scales; distal subdigital lamellae divided; male preanal pores in two rows (12–16 in anterior row, 8–11 in posterior row). In addition, 27 presacral vertebrae (and concomitant reduction of pygal vertebrae to 4 rather than 5) have been recorded in a single specimen (CAS 198703), whereas this condition is not present in members of any other species examined, all of which have 26 presacral vertebrae. Narrow beige and dark brown stripes bordering dorsal pale region well-developed, beige stripe wider over sacrum and tail base than elsewhere.



FIGURE 1. Life photograph of a gravid female *Dierogecko validiclavis* with relatively weakly developed yellowish dorsal markings, from Mt. Panié, Province Nord, New Caledonia. Photo by R.A. Sadlier.



FIGURE 2. Life photograph of a male *Dierogecko validiclavis* with grayish-brown dorsal markings contrasting strongly from mid-brown flanks, from Mt. Panié, Province Nord, New Caledonia. Photo by R.A. Sadlier.

DESCRIPTION.— see Sadlier (1989).

DISTRIBUTION AND NATURAL HISTORY.— This species is the only member of its genus to occur on the east coast of the Grande Terre. It has been collected only on Mt. Panié (Taaluny) and Mt. Mandjélia (Tidiélic) (Fig. 3), but may be expected to occur in appropriate habitats of the Massif du Panié on Mt. Colnett (Bwa Yonâ) and Mt. Ignambi (Ngâbi), which lie between the two known localities. All known localities are at low- to mid-elevation, 400–500 m. Specimens have been collected by day sheltering beneath rocks and logs in closed humid forest (Sadlier 1989) (Fig. 4). Dominant canopy species at this elevation include species of *Anthocarapa*, *Archidendropsis*, *Calophyllum*, *Crossostylis*, *Cryptocarya*, *Cunonia*, *Dysoxylum*, *Ficus*, *Montrouziera*, *Neubergia*, *Pycnanandra*, *Schefflera* and *Syzygium* (Conservation International and Maruia Society 1998). These localities receive significantly more rainfall than do those of any of the other species in the genus (Sautter 1981). The herpetofauna of the Panié Massif is quite rich (Bauer and Sadlier 2000) and includes a number of other diplodactylids, including *B. madjo* as well as *B. cf. montana* and *B. cf. cyclura* (Bauer et al. 2000; Bauer and Sadlier 2000).

CONSERVATION STATUS.— The Massif du Panié is one of the largest forested areas in New Caledonia and Mt. Panié itself is included in the Réserve Spéciale Botanique de Mt. Panié, which has had at least nominal protection since 1950 (Conservation International and Maruia Society

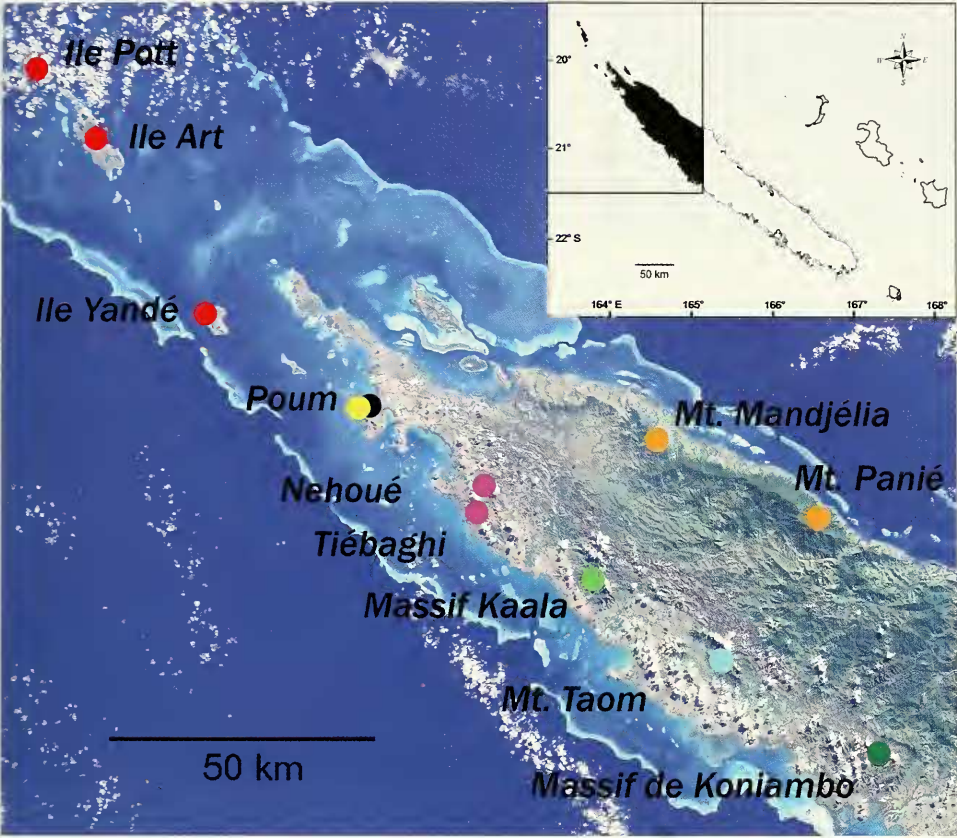


FIGURE 3. Landsat 7 image of the northern portion of the Province Nord, New Caledonia, showing the collection localities of the eight species of *Dierogecko*. Key: orange = *D. validiclavis*, dark green = *D. koniambo*, light green = *D. kaalaensis*, blue = *D. thomaswhitei*, purple = *D. nehoeensis*, red = *D. insularis*, black = *D. poumensis*, yellow = *D. inexpectatus*. Image from the Millenium Coral Reef Landsat Archive.

1998). Mt. Panié itself has never been populated and more than 32,500 ha of rainforest remain on the massif (Jaffré et al. 1998). It is widely regarded as one of the most critical conservation areas in New Caledonia (Conservation International and Maruia Society 1998; Ekstrom et al. 2000). *Dierogecko validiclavis* may be potentially at risk from agricultural clearing and burning at low elevation on the east coast of New Caledonia and from mid-elevation timber extraction on Mt. Mandjélia, as well as from introduced fire ants, which are locally abundant at low elevation on Mt. Panié, rats and cats. However, most of these threats affect only the forest edge and the core closed forest habitat of this species is generally well protected. On this basis *D. validiclavis* is regarded as Vulnerable (Sadler and Bauer 2003).



FIGURE 4. Forested habitat of *Dierogecko validiclavis* on the slopes of the Massif du Panié, Province Nord, New Caledonia. Photo A.M. Bauer.

***Dierogecko koniambo* Bauer, Jackman, Sadlier, and Whitaker, sp. nov.**

Figures 5–6.

TYPE MATERIAL.—HOLOTYPE: MNHN 2004.0016 (formerly AMS R 161128): Adult male; New Caledonia, Province Nord, Massif de Koniambo, 8 km NE Koné, headwaters of Rivière Pandanus, 20°59'42.5"S, 164°48'56.0"E (elevation 800 m), collected by A.H. Whitaker and V.A. Whitaker, 7 June 2002. PARATYPES: AMS R 161114, 161130, CAS 231874–75: Adult males; AMS R 161131, CAS 231873: Adult females; New Caledonia, Province Nord, Massif de Koniambo, 8 km NE Koné, headwaters of Rivière Pandanus, 20°59'42.5"S, 164°48'56.0"E (elevation 850 m), collected by A.H. Whitaker and V.A. Whitaker, 6 June 2002.

ETYMOLOGY.—The species name *koniambo* is a noun in apposition and refers to the ultramafic massif (maximum elevation 940 m) to which this species appears restricted.

DIAGNOSIS.—*Dierogecko koniambo* can be distinguished from all congeners on the basis of the following combination of characters: size intermediate (to 43.0 mm SVL), 1–2 (rarely three) internasal scales; distal subdigital lamellae divided; male preanal pores in a single row of 10–12. Narrow beige and dark brown stripes bordering pale dorsal region weakly developed, sometimes absent, on body between nape and sacrum.

DESCRIPTION (based on holotype).—Adult male. SVL 42.6 mm; TailL 40.8 mm (distal 23.5 mm regenerated). Head moderately long (HeadL/SVL ratio 0.29), relatively narrow (HeadW/HeadL ratio 0.59), somewhat depressed (HeadH/HeadL ratio 0.41), set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout moderately elongate (SnEye/HeadL ratio 0.40), blunt; longer than eye diameter (OrbD/SnEye ratio 0.64); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout much larger than those on occipital region. Eye relatively large (OrbD/HeadL ratio 0.25); pupil vertical with crenelated margins; supraciliaries short, bearing 1–3 elongate spines near posterodorsal margin of orbit. Ear opening oval, angled posterodorsally at an angle of 45° from horizontal, relatively large (EarL/HeadL ratio 0.12); eye to ear distance subequal to diameter of eyes (EyeEar/OrbD ratio 1.02). Rostral wider (1.6 mm) than deep (1.2 mm), incompletely divided dorsally. Two moderately enlarged supranasals separated by three hexagonal internasals in a single transverse row. Rostral in contact with first supralabials, nostrils, supranasals and all three internasals. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals. At least four rows of small scales separate orbit from supralabials. Mental triangular, approximately as wide (1.2 mm) as deep (1.2 mm). A single enlarged (15–20 times size of granular throat scales) hexagonal postmental, anterior apex narrowest, bordered by mental, first infralabials, and five enlarged chin shields, three posteriorly and one each posterolaterally. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 7/6; total enlarged supralabials 9/7; supralabial scales to angle of jaws 12/11. Enlarged infralabials 9/7; infralabials to angle of jaws 12/11. Interorbital scale rows across narrowest point of frontal bone 17.

Body slender, elongate (TrunkL/SVL ratio 0.43); no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales larger than dorsals, smooth, hexagonal and subimbricate to imbricate, roughly uniform in size across venter. Approximately 124 scale rows around midbody. Gular region with homogeneous, smooth granular scales, equivalent in size to dorsal granules.

No enlarged precloacal or femoral scales; precloacal pores relatively small, in single angled series of 10, with a single poreless scale separating left and right pores; no femoral pores. 2(L)–3(R) enlarged, smooth, conical cloacal spurs.

Scales on palm and sole smooth, rounded. Scalation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeaL/SVL ratio 0.11; CrusL/SVL ratio 0.14). Digits



FIGURE 5. Holotype of *Dierogekko koniambo* (MNHN 2004.0016) from the Massif de Koniambo, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.

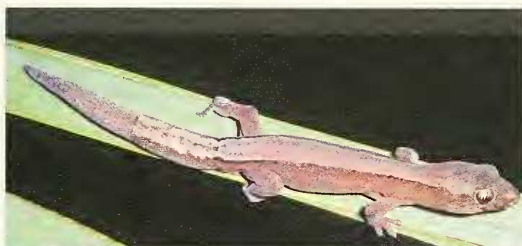


FIGURE 6. Life photograph of the holotype of *Dierogekko koniambo* (MNHN 2004.0016). Photo by A.H. Whitaker.

moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately twice size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and divided beneath distal phalanges (except terminal scansors). Scansors (terminal scansors of digit I not included in counts): 4–8–11–11–9 manus; 6–9–12–13–12 pes. Relative length of digits: IV>III>II>V>I (manus); IV>III~V>II>I (pes); interdigital webbing weakly developed between all digits of manus and digits I–IV of pes, absent between digits IV and V of pes. Regenerated tail approximately equal to body length (TailL/SVL ratio 0.96), thick, slightly constricted at base, tapering gradually along distal $\frac{1}{4}$. No caudal tubercles; dorsal caudal scales subconical basally, becoming flatter distally, pentagonal with free margins rounded, juxtaposed to subimbricate, eight rows per tail segment; subcaudal scales approximately 1.5 times larger than dorsals.

Osteology: Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 5.5 post pygal caudal vertebrae anterior to regenerate region in tail of holotype (6.5 post pygal vertebrae to point of regeneration in longest-tailed paratype, CAS 231875). Holotype and male paratypes with one pair of crescentic cloacal bones at the level of second to third pygal vertebrae. Endolymphatic sacs not enlarged extracranially.

Coloration (in preservative): Dorsal ground color mid- to dark brown, with a broad median region of paler grayish-brown extending from top of head onto tail, edged on each side by two incomplete and diffuse stripes, the inner beige and outer dark brown; stripes most prominent on nape and over lumbar and sacral regions; stripes discrete on sacrum, but becoming more diffuse on tail base, with dark stripe fading entirely and light stripe expanding and fusing with that of opposite side to form a series of cream to beige blotches on dorsum of original tail. Area from nostril through ventral half of orbit to above ear opening darker than adjacent surfaces. Labial scales mid- to dark brown with cream spots within scales or bracketing sutures. Iris coppery with brownish reticulations. Flanks mid-brown. Limbs uniform brown; palms, soles and subdigital surfaces brown to grayish-brown. Dorsum of regenerated portion of tail midbrown with irregular darker markings. Venter beige with extensive brown flecks on most scales, especially laterally and under limbs. Chin and throat brown with a large oval central spot free of pigment. Venter of original portion of tail mottled light brown; venter of regenerate grayish-brown.

VARIATION.— Comparative mensural data for the holotype and paratypes are given in Table 3. Meristic characters of paratypes are mostly similar to those of the holotype, and are mentioned hereafter if they differ. Only one (AMS R 161114, 161130–31) or two (CAS 231873–75) internasals in paratypes. Precloacal pores in single row of 10 (CAS 231874), 11 (AMS R 161130), or 12 (AMS R 161114, CAS 231875) in male paratypes, absent in females. Precloacal pores in continuous series (AMS R 161130, CAS 231875), or with one (AMS R 161114) or three (CAS 231874) poreless

scales between left and right series.

Dorsum more-or-less uniform yellowish-brown with dorsal stripes absent except for some trace on sacrum and nape only in AMS R 161114 and 161131. Vertebral region yellowish-brown with bordering stripes variably developed, contrasting with greyish brown dorsolateral and lateral surfaces in AMS R 161129 and CAS 231875. CAS 231874 intermediate in pattern boldness between holotype and CAS 231873. AMS R 161130 similar to holotype but with light stripes bordering vertebral region more prominent. Throat heavily mottled with brown in AMS R 161130 and CAS 231874–75, less strongly pigmented in CAS 231873 and AMS R 161131 and very faintly pigmented in AMS R 161114. All paratypes lack the oval pigmentless gular patch of the holotype.

DISTRIBUTION AND NATURAL HISTORY.— This species is known only from the Massif de Koniambo, an ultramafic peak (maximum 940 m elevation) in the northwestern Grande Terre (Fig. 3). The vegetation of Koniambo was discussed by Jaffré (1974). Specimens were collected in montane closed forest on the summit plateau. The species was also observed in maquis at mid-elevation (500–600 m). Seven mites (probably Trombiculidae) were located on one specimen (AMS R 161129), three around margin of right eye, one attached to the margin of the left eye, and one each anterior to the insertion of the left forelimb, in the left axillary “pocket,” and above the right forelimb insertion.

Other reptiles collected at or near the type locality include *Bavayia* aff. *montana*, *Enrydactylodes vieillardii*, *Rhacodactylus auriculatus*, *Caledoniscincus austrocaledonicus*, *C. atropunctatus*, *Lioscincus nigrofasciolatus*, *Marmorosphax tricolor*, and *Tropidoscincus boreus* (Whitaker et al. 2004).

CONSERVATION STATUS.— *Dierogekko koniambo* was abundant at its type locality in 2002, with as many as 15 individuals occupying a single small tree and was also abundant in maquis at lower elevation (Whitaker et al. 2004). However, it is at risk from several threats. Introduced mammals including *Rattus rattus*, *R. exulans*, and feral cats occur on Koniambo and are potential predators. In addition deer (*Cervus timorensis*) and feral pigs are also present and may be expected to degrade the vegetation. More significantly, the Massif de Koniambo is being developed as a major nickel mine, thus placing the only known locality for this gecko at grave risk. On this basis we regard the species as Critically Endangered.

***Dierogekko kaalaensis* Bauer, Jackman, Sadlier, and Whitaker, sp. nov.**

Figures 7–8.

TYPE MATERIAL.— **HOLOTYPE:** MNHN 2004.0017 (formerly AMS R 161096): Adult male; New Caledonia, Province Nord, Kaala massif, headwaters of Oué Injob, 6 km N Kaala-Gomen, 20°37'03.2"S, 164°22'49.0"E (elevation 900 m), collected by A.H. Whitaker and V.A. Whitaker, 2 June 2002. **PARATYPES:** AMS R 161098, CAS 231870: Adult males; AMS R 161097, CAS 231871: Adult females; collection data as for holotype. CAS 231872: Adult female; New Caledonia, Province Nord, Kaala massif, east side Piton de Pandop, 9 km SE Koumac, 20°35'16.5"S, 164°22'04.6"E (elevation 500 m), collected by A.H. Whitaker and V.A. Whitaker, 3 June 2002.

ETYMOLOGY.— The specific epithet *kaalaensis* is derived from the Kaala massif, the ultramafic mountain (1079 m maximum elevation) to which this species appears restricted.

DIAGNOSIS.— *Dierogekko kaalaensis* can be distinguished from all congeners on the basis of the following combination of characters: size relatively large (to 45.4 mm SVL), 1–2 internasal scales; distal subdigital lamellae divided; male preanal pores in a single row of 12–15. Narrow dark brown markings bordering dorsal pale region laterally reduced to a series of widely spaced dark speckles corresponding to individual granular scales.

DESCRIPTION (based on holotype).— Adult male. SVL 42.2 mm; TailL 41.8 mm (distal 30.4

mm regenerated). Head relatively short (HeadL/SVL ratio 0.27) and wide (HeadW/HeadL ratio 0.70), depressed (HeadH/HeadL ratio 0.34), weakly set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout moderately short (SnEye/HeadL ratio 0.37), blunt; longer than eye diameter (OrbD/SnEye ratio 0.60); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout much larger than those on occipital region. Eye moderately large (OrbD/HeadL ratio 0.22); pupil vertical with crenelated margins; supraciliaries short, bearing 1–3 elongate spines near posterodorsal margin of orbit. Ear opening oval, angled posterodorsally at an angle of 45° from horizontal, relatively large (EarL/HeadL ratio 0.14); eye to ear distance greater than diameter of eyes (EyeEar/OrbD ratio 1.16). Rostral much wider (2.3 mm) than deep (1.3 mm), incompletely divided dorsally. Two moderately enlarged supranasals separated by one large hexagonal internasal. Rostral in contact with first supralabials, nostrils, supranasals and internasal. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals. At least four rows of small scales separate orbit from supralabials. Mental triangular, wider (1.9 mm) than deep (1.2 mm). A single enlarged (15–20 times size of granular throat scales) irregular, octagonal postmental, anterior and posterior apices narrowest, bordered by mental, first infralabials, and five enlarged chin shields, three posteriorly and one each posterolaterally. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 7/8; total enlarged supralabials 10/11; supralabial scales to angle of jaws 13/15. Enlarged infralabials 9/8; infralabials to angle of jaws 13/12. Interorbital scale rows across narrowest point of frontal bone 15.

Body slender, moderately elongate (TrunkL/SVL ratio 0.38); no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales larger than dorsals, smooth, with rounded free margins, subimbricate to imbricate, roughly uniform in size across venter. Approximately 129 scale rows around midbody. Gular region with homogeneous, smooth granular scales, equivalent in size to dorsal granules.

No enlarged precloacal or femoral scales; precloacal pores relatively small, in single angled series of 12, with a single poreless scale separating left and right pores; no femoral pores. Two enlarged, smooth, conical, somewhat laterally projecting cloacal spurs, posteroventral spur larger.

Scales on palm and sole smooth, rounded. Scalation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeL/SVL ratio 0.13; CrusL/SVL ratio 0.15). Digits moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less



FIGURE 7. Holotype of *Dierogecko kaalaensis* (MNHN 2004.0017) from headwaters of the Oué Injob, Kaala massif, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.



FIGURE 8. Life photograph of male paratype of *Dierogecko kaalaensis* (AMS R 161098) from headwaters of the Oué Injob, Kaala massif, Province Nord, New Caledonia. Photo by A.H. Whitaker.

strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately twice size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and divided beneath distal phalanges (except terminal scansors). Scansors (terminal scansors of digit I not included in counts): 5-8-11-12-12 manus; 5-10-12-13-12 pes. Relative length of digits: IV>III>II>V>I (manus); IV>III~V>II>I (pes); interdigital webbing weakly developed between all digits of manus and digits I-IV of pes, absent between digits IV and V of pes. Regenerated tail approximately equal to body length (TailL/SVL ratio 0.99), thick, slightly constricted at base, tapering gradually along distal $\frac{1}{3}$. No caudal tubercles; dorsal caudal scales squarish to oval, juxtaposed to subimbricate, eight rows per tail segment; subcaudal scales approximately 1.5 times larger than dorsals, more strongly imbricating.

Osteology: Parietal bones paired; stapes imperforate. Phalangeal formula 2-3-4-5-3 for manus and 2-3-4-5-4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 3.5 post pygal caudal vertebrae proximal to regenerated portion of tail (17.5 post pygal vertebrae to point of regeneration in paratype with longest tail, CAS 231870). Holotypes and male paratypes with one pair of crescentic cloacal bones present at level of second to third pygal vertebrae. Endolymphatic sacs not enlarged extracranially. In the juvenile specimen, CAS 231871, the epiphyses of the long bones remain unfused.

Coloration (in preservative): Dorsal ground color uniform medium brown, with single dark brown granular scales scattered on dorsum, especially in two parallel parasagittal longitudinal lines, each consisting of about 10 widely spaced dark granular scales. A pair of very faint, but more continuous longitudinal markings on pygal portion of tail, each consisting of a more medial beige stripe and a more lateral dark brown line, each about three granular scales in width, becoming fainter and more sinuous on original postpygal portion of tail. Regenerated portion of tail medium brown with irregularly scattered dark brown scales. Snout uniform medium brown, sides of neck with some mottling. Labials dark brown with cream (pigmentless) spots. Iris coppery with brownish reticulations. Flanks somewhat paler than dorsum and slightly mottled. Limbs similar to dorsum; palms, soles and subdigital surfaces brown to grayish-brown. Venter beige with many brown flecks on individual scales, pigmentation heaviest under limbs, around cloaca and on mottled chin and throat. Venter of both original and regenerated portions of tail grayish-brown with scattered darker brown scales.

VARIATION.—Comparative mensural data for the holotype and paratypes are given in Table 4. Meristic characters of paratypes are mostly similar to those of the holotype, and are mentioned hereafter if they differ. Mostly original tail of CAS 231870 is 118% of SVL. Two internasal scales in all paratypes except CAS 231871. All paratypes with only two scales bordering enlarged postmental posteriorly. Number and size of enlarged supraciliary scales highly variable across type series. Precloacal pores in male paratypes in a single series of 8 (left) and (7) right, separated by one poreless scale (CAS 231870) or in a continuous series of 13 (AMS R 161098).

Distinctness of middorsal stripe variable. Most specimens with stripe distinctly more yellowish-brown than remainder of dorsum and flanks more grayish-brown than in holotype (e.g. AMS R 161097-98, CAS 231872). Borders of middorsal stripe always more well defined on lumbar and sacral regions and on nape. Borders consisting of small scattered dark markings in AMS R 161097-98, CAS 231871, more-or-less complete lateral dark lines and incomplete medial beige lines in CAS 231870, and incomplete beige lines with very narrow dark brown lateral borders in CAS 231872. Top of head generally same color as middorsal stripe, either uniform (AMS R 161097, CAS 231872) or with dark speckling (AMS R 161098) or heavier patterning with larger dark markings continuing on to snout (CAS 231871). Original tail of CAS 231870 boldly patterned with contiguous light brown blotches with dark brown borders. Degree of ventral pigmentation

comparable to holotype except in CAS 231872, which is distinctly paler.

DISTRIBUTION AND NATURAL HISTORY.—

This species is known only from the Kaala massif, an ultramafic peak (1079 m maximum elevation) in the northwestern Grande Terre (Fig. 3). The vegetation of Kaala was discussed by Virot (1956). Piton de Pandop (823 m) is the northernmost peak in the Kaala massif, lying north of the Oué Tenguoa catchment. The specimens from the headwaters of Oué Injob were collected on small shrubs in maquis vegetation (Fig. 9), while that from Piton de Pandop was in closed forest. This species has also been found in riparian forest in the lower reaches of the Oué Injob (80 m elevation).

Other reptiles collected at the headwaters of the Oué Injob include *Eurydactylodes agricolae*, *Rhacodactylus auriculatus*, *Caledoniscincus atropunctatus*, *Marmorosphax* aff. *tricolor*, and *Tropidoscincus boreus*. In addition, *Bavayia* aff. *cyclura* and *Lioscincus nigrofasciatus* have been collected at the paratype locality at Piton de Pandop, and at the low elevation site *Hemidactylus frenatus*, *Oedodera marmorata*, and an undescribed member of the *Bavayia cyclura* complex are present.



FIGURE 9. Habitat of *Dierokekko kaalaensis* in maquis vegetation on the slopes of Piton de Pandop, Kaala massif, Province Nord, New Caledonia. Photo by A.H. Whitaker.

CONSERVATION STATUS.— *Dierokekko*

kaalaensis is known only from three localities on the Kaala massif. The area supports introduced *Rattus* species, cats, deer and pigs and has been heavily exploited by mining. Two mines on the summit of the massif are still active and there are current plans to re-open one of the old mines on the western slopes. In addition, recent wildfires have severely affected the western slopes of Kaala. As this species is at potential risk from several threats in its restricted range, we regard it as Critically Endangered.

***Dierokekko thomaswhitei* Bauer, Jackman, Sadlier, and Whitaker, sp. nov.**

Figures 10–12.

TYPE MATERIAL.— **HOLOTYPE:** MNHN 2004.0016: Adult male; New Caledonia, Province Nord, Massif d'Ouazangou-Taom, Mt. Taom, vicinity Gomen Mine, 20°46'40"S, 164°34'38"E (elevation 870 m), collected by R.A. Sadlier, T. Jackman and G. Watkins-Colwell, 23 January 2003. **PARATYPES:** CAS 231837, AMS R 166975: Adult males; CAS 231838; Juvenile female; same collection data as holotype. AMS R 161153, 161178, CAS 231877: Adult males; AMS R 161180, CAS 231876: Adult females; New Caledonia, Province Nord, Massif d'Ouazangou-Taom, Mt. Taom, Gomen Mine, 12 km NE Ouaco, Province Nord, New Caledonia, 20°46'36.0"S, 164°33'44.9"E (elevation 850 m), collected by A.H. Whitaker and V.A. Whitaker, 11 June 2002.

ETYMOLOGY.— The specific epithet is a patronym honoring Dr. Thomas White, through whose generosity the automated sequencer used in our molecular phylogenetic analyses of the New

Caledonian lizard fauna was obtained. The name is masculine and is formed in the genitive singular.

DIAGNOSIS.— *Dierogecko thomaswhitei* can be distinguished from all congeners on the basis of the following combination of characters: size relatively large (to 44.9 mm SVL), 1 internasal scale; distal subdigital lamellae divided; male preanal pores in two rows (12–14 in anterior row, 1–5 in posterior row). Narrow beige and dark brown longitudinal stripes vague, cream markings coalesce over forelimb insertion, sacrum, and tail base; dorsal surface of head darker than lateral.

DESCRIPTION (based on holotype).— Adult male. SVL 41.7 mm; TailL 39.0 mm (distal 23.4 mm regenerated). Head relatively short (HeadL/SVL ratio 0.30), relatively narrow (HeadW/HeadL ratio 0.63), moderately depressed (HeadH/HeadL ratio 0.38), set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout short (SnEye/HeadL ratio 0.33), blunt; longer than eye diameter (OrbD/SnEye ratio 0.68); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout larger than those on occipital region. Eye moderately large (OrbD/HeadL ratio 0.23); pupil vertical with crenelated margins; supraciliaries short, bearing 1–3 elongate spines near posterodorsal margin of orbit. Ear opening oval, angled posterodorsally at an angle of 45° from horizontal, relatively large (EarL/HeadL ratio 0.13); eye to ear distance slightly greater than diameter of eyes (EyeEar/OrbD ratio 1.05). Rostral much wider (2.1 mm) than deep (1.1 mm), incompletely divided dorsally. Two moderately enlarged supranasals separated by one large internasal, approximately same size as supranasals. Rostral in contact with first supralabials, nostrils, supranasals and internasal. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals. At least four rows of small scales separate orbit from supralabials. Mental triangular, wider (1.1 mm) than deep (0.9 mm). A single enlarged (approximately 12 times size of granular throat scales) irregular, heptagonal postmental, anterior and posterior apices narrowest, bordered by mental, first infralabials, and five enlarged chin shields, three posteriorly and one each posterolaterally. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 8/9; total enlarged supralabials 10/10; supralabial scales to angle of jaws 13/14. Enlarged infralabials 9/10; infralabials to angle of jaws 12/13. Interorbital scale rows across narrowest point of frontal bone 16.

Body slender, moderately elongate (TrunkL/SVL ratio 0.38); no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales larger than dorsals, smooth, with rounded free margins, subimbricate to imbricate, roughly uniform in size across venter. Approximately 121 scale rows around midbody. Gular region with homogeneous, smooth granular scales, equivalent in size to dorsal granules.

No enlarged precloacal or femoral scales; precloacal pores relatively small, in two angled series in adjacent scale rows, anterior continuous row of 13 pores, posterior row of one pored scale (left) separated by five poreless scales from two pores on right side. Two enlarged, smooth, conical, somewhat laterally projecting cloacal spurs, anterodorsal spur larger.

Scales on palm and sole smooth, rounded. Scalation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeaL/SVL ratio 0.13; CrusL/SVL ratio 0.14). Digits moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately 1.5 times size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and divided beneath distal phalanges (except terminal scansors). Scansors (terminal scansors of digit I not included in counts): 5–8–10–11–10 manus; 6–8–12–12–10 pes. Relative length of digits: IV>III>II>V>I (manus); IV>III~V>II>I (pes); interdigital webbing moderately developed between all digits of manus and digits I–IV of pes, absent between digits IV and V of pes.

Regenerated tail approximately equal to body length (TailL/SVL ratio 0.94), moderately thick, very slightly constricted at base, tapering gradually along distal 1/4. No caudal tubercles; dorsal caudal scales squarish to oval, juxtaposed to subimbricate, eight rows per tail segment; subcaudal scales rectangular, approximately 1.5 times larger than dorsals, more strongly imbricating.

Osteology: Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 6.5 post pygal caudal vertebrae proximal to regenerated portion of tail (19.5 post pygal vertebrae to point of regeneration in specimen with relatively longest original tail, CAS 231838). Holotype and male paratypes with one pair of crescentic cloacal bones present at level of second to third pygal vertebrae. Endolymphatic sacs not enlarged extracranially. Epiphyses of long bones incompletely fused in juvenile specimen CAS 231838.

Coloration (in preservative): Dorsal ground color medium brown, with small (a single granule in extent) dark brown and cream marks forming vaguely pair of longitudinal stripes. Cream marks coalescing to form faint lines above forelimb insertion and over sacrum and pygal portion of tail. Cream lines on sacrum and tail base bordered laterally by dark brown lines. Pattern carries onto tail as an irregular buff to beige marking with dark brown borders. Regenerated portion of tail medium brown with irregularly scattered dark brown scales. Area from forelimb insertion to angle of jaws mottled with cream to beige spots. Dorsal surface of head darker than lateral. Labials dark brown with cream pigmentless spots. Iris coppery with brownish reticulations. Upper surfaces of limbs similar to dorsum; palms, soles and subdigital surfaces brown to grayish-brown. Venter beige with brown punctations on most scales, pigmentation heaviest under limbs, at margins of flanks, and on heavily mottled chin and throat. Venter of both original and regenerated portions of tail light brown with scattered beige and dark brown scales.

In life the groin and throat of the holotype were yellow mottled with brown.

VARIATION.— Comparative mensural data for the holotype and paratypes are given in Table 5.



FIGURE 10. Holotype of *Dierogekko thomaswhitei* (MNHN 2004.0018) from vicinity of Gomen Mine, Mt. Taom, Massif d'Ouazangou-Taom, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.



FIGURE 11. Life photograph of male paratype of *Dierogekko thomaswhitei* (CAS 231877) illustrating the relatively bold patterning typical of some specimens. Photo by A.H. Whitaker.



FIGURE 12. Life photograph of female paratype of *Dierogekko thomaswhitei* (AMS R 161180) with the pale vertebral stripe barely distinguishable. Photo by A.H. Whitaker.

Meristic characters of paratypes are mostly similar to those of the holotype, and are mentioned hereafter if they differ. Mostly original tail of CAS 231838 is 102% of SVL. Precloacal pores in male paratypes in two series, anterior row with 12 (CAS 231837, 231877) or 14 (AMS R 161153, 161178, 166975) pores, posterior row with 1 (AMS R 161178) pore, 2 pores (one on each side separated by 4 poreless scales; CAS 231877), 4 pores (two on left separated from two on right by four poreless scales; AMS R 161153, CAS 231837), or 5 pores (two on left separated from three on right by three poreless scales; AMS R 166975).

Middorsal stripe weakly developed, except on sacrum, in all paratypes, but distinctly lighter than remainder of dorsum in CAS 231838, AMS R 161153 and AMS R 166975. Dorsum nearly uniform yellowish-brown in CAS 231837. Loreal markings especially prominent and a dark streak from rostral to level of anterior border of orbit in CAS 231838. Venter pale in CAS 231837, almost lacking dark pigment all together in AMS R 161153. Regenerated portion of tail darker than original in all paratypes. In life AMS R 166975 had a pale yellow groin, while CAS 231837 and 231838 had pale, cream colored venters.

DISTRIBUTION AND NATURAL HISTORY.— This species is known only from Mount Taom, an ultramafic peak (1092 m maximum elevation), part of the large Massif d'Ouazangou-Taom in the northwestern Grande Terre of New Caledonia (Fig. 3). The vegetation of the summit area was briefly described by Whitaker et al. (2004). The types were collected in closed forest (AMS R 161153, CAS 231876) or at the border of closed forest and maquis (MNHN 2003.0016, CAS 231837–38, 231877, AMS R 166975, 161178, 161180) above the Gomen Mine (800 m). Additional specimens were observed, but not collected, at lower elevations (350 m and 650 m) in maquis shrub (Fig. 13).

Other reptiles collected in the vicinity of the Gomen Mine on Mount Taom include *Bavayia* aff. *exsuccida*, *Bavayia* aff. *montana*, *Eurydactylodes agricolae*, *Caledoniscincus aquilonius*, *C. austrocaledonicus*, *Marmorosphax* aff. *tricolor*, *Tropidoscincus boreus*, a new species of skink allied to "*Lygosoma*" *eurytis* (Sadlier et al. 2006), and a new genus and species of skink (Sadlier et al., in prep.). *Hemidactylus frenatus* and *Caledoniscincus haplorhinus* have been found at lower elevations on the mountain (Whitaker et al. 2004).

CONSERVATION STATUS.— Under favorable weather conditions, *D. thomaswhitei* were abundant on shrubby vegetation above the Gomen Mine and were present at mid-elevations as well. The area harbors the introduced *Rattus rattus*, and deer, feral cats, and pigs are numerous at lower elevations. The mine was inactive at the time of our visits to the site, but it has since been reopened by the Société Minière du Sud Pacifique (SMSP) and poses a potential threat to the habitat of this species. Although this gecko may also occur on adjacent peaks within the massif, we regard it as Critically Endangered.

***Dierogecko nehoueensis*, Bauer, Jackman, Sadlier, and Whitaker, sp. nov.**

.Figures 14–16.

TYPE MATERIAL.— HOLOTYPE: MNHN 2004.0019: Adult male: New Caledonia, Province Nord, Rivière Néhoué, 20°25'03"S, 164°13'15"E (elevation 5 m), collected by A.M. Bauer, R.A. Sadlier, T.



FIGURE 13. Habitat of *Dierogecko thomaswhitei* in maquis shrubland on Mt. Taom in the Massif d'Ouazangou-Taom, Province Nord, New Caledonia. Photo by A.H. Whitaker.

Jackman, S.A. Smith and G. Watkins-Colwell, 22 January 2003. PARATYPES: CAS 231835: Adult female, CAS 231836: Adult male; same collection data as holotype. AMS R 166976: Adult female; same locality and collectors holotype, 25 January 2003. CAS 231855: Subadult female; New Caledonia, Province Nord, Rivière Néhoué, 20 km NW Koumac, 20°24'27.0"S, 164°12'09.3"E (elevation 5 m), collected by A.H. Whitaker and V.A. Whitaker, 3 October 2001. CAS 231863: Adult male, CAS 231864, AMS R 161242–44: Adult females; New Caledonia, Province Nord, Dôme de Tiébaghi, 14 km NW Koumac, 20°27'37.8"S, 164°11'11.2"E (elevation 340 m), collected by A.H. Whitaker and V.A. Whitaker, 17 October 2001.

ADDITIONAL MATERIAL.— AMS R 166970, CAS 231854: New Caledonia, Province Nord, Rivière Néhoué, 20 km NW Koumac, 20°25'12.3"S, 164°13'04.5"E (elevation 5 m), collected by A.H. Whitaker and V.A. Whitaker, 29 September 2001. AMS R 161246: same collection data as for CAS 231863.

ETYMOLOGY.— The specific epithet is derived from the Rivière Néhoué, the type locality of the species and one of only three known localities where it occurs. The gallery forest along this small river is the type locality for two other species, *Kanakysaurus viviparus* and *Eurydactylodes agricolae*, and is one of the most herpetologically important lowland sites in the Province Nord. It has previously been recognized as having high conservation value (Veillon et al. 1999).

DIAGNOSIS.— *Dierogecko nehoueensis* can be distinguished from all congeners on the basis of the following combination of characters: size relatively small (to 40.3 mm SVL), 1–2 internasal scales; distal subdigital lamellae divided; male preanal pores in two rows (12 in anterior row, 5–8 in posterior row). Narrow beige and dark brown lines bordering dorsal pale region well developed, dark brown line medial to beige stripe present from lumbar region onto tail base.

DESCRIPTION (based on holotype).— Adult male. SVL 40.3 mm; TailL 36.2 mm (distal 32.1 mm regenerated). Head moderately long (HeadL/SVL ratio 0.31), relatively wide (HeadW/HeadL ratio 0.70), depressed (HeadH/HeadL ratio 0.34), weakly set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout short (SnEye/HeadL ratio 0.33), blunt; longer than eye diameter (OrbD/SnEye ratio 0.64); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout much larger than those on occipital region. Eye moderately large (OrbD/HeadL ratio 0.21); pupil vertical with crenelated margins; supraciliaries short, bearing two elongate spines near posterodorsal margin of orbit. Ear opening oval, angled posterodorsally at an angle of 45° from horizontal, relatively small (EarL/HeadL ratio 0.10); eye to ear distance greater than diameter of eyes (EyeEar/OrbD ratio 1.20). Rostral much wider (2.0 mm) than deep (0.9 mm), nearly completely divided by rostral crease, except near margin of lip. Two relatively small supranasals separated by one very large pentagonal internasal. Rostral in contact with first supralabials, nostrils, supranasals and internasal. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals; nasal narrowly separating two granules from nostril rim; supralabial in very narrow contact with nostril. At least four rows of small scales separate orbit from supralabials. Mental triangular, wider (1.2 mm) than deep (1.0 mm). A single enlarged (~12 times size of granular throat scales) irregular, hexagonal postmental, anterior apex narrowest, bordered by mental, first infralabials, and four enlarged chin shields, two posteriorly and one each posterolaterally. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 7/8; total enlarged supralabials 9/10 supralabial scales to angle of jaws 13/14. Enlarged infralabials 9/9; infralabials to angle of jaws 12/12. Interorbital scale rows across narrowest point of frontal bone 15.

Body slender, elongate (TrunkL/SVL ratio 0.43); no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales larger than dorsals, smooth, with rounded free margins, subimbricate to imbricate, roughly uniform in size across most of venter, slightly enlarged in precloacal region. Approximately 142 scale rows around midbody. Gular region with homogeneous, smooth granular scales, equivalent in size to dorsal granules.

No enlarged precloacal or femoral scales; precloacal pores relatively small, in two angled series in adjacent scale rows; anterior continuous series of 12 pores, posterior continuous series of 6 pores. Two enlarged, smooth, conical, somewhat laterally projecting cloacal spurs, anterodorsal spur larger.

Scales on palm and sole smooth, rounded. Scalation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeL/SVL ratio 0.13; CrusL/SVL ratio 0.15). Digits moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately twice size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and divided beneath distal phalanges (except terminal scansors). Scansors (terminal scansors of digit I not included in counts): 5–9–11–12–9 manus; 5–10–13–12–11 pes. Relative length of digits: IV>III>II>V>I (manus); IV>III~V>II>I (pes); interdigital webbing moderately developed between all digits of manus and digits I–IV of pes, absent between digits IV and V of pes. Regenerated tail approximately equal to body length (TailL/SVL ratio 0.99), thick, slightly constricted at base, tapering gradually along distal $\frac{1}{3}$. No caudal tubercles; dorsal caudal scales squarish with rounded free margins, juxtaposed to submibricate; subcaudal scales slightly larger than dorsals, more strongly imbricating.

Osteology: Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 0.5 post pygal caudal vertebrae proximal to regenerated portion of tail (approximately 26 post pygal vertebrae in original tail of CAS 231836 and at least 23 in CAS 231835 – divisions in small, irregular terminal vertebrae difficult to discern). Male paratypes with one pair of crescentic cloacal bones present, flared posterolaterally, at level of second to third pygal vertebrae (cloacal bones lacking in female holotype). Endolymphatic sacs not enlarged extracranially.

Coloration (in preservative): Flanks mid-brown fading to gray-brown on lower margins. A broad middorsal, yellowish-brown stripe extending from snout to tail base, bordered laterally by two narrow stripes, a more medial cream stripe (approximately 3 granular scales in width) running



FIGURE 14. Holotype of *Dierogecko nehoueensis* (MNHN 2004.0019) from Rivière Néhoué, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.



FIGURE 15. Life photograph of female paratype of *Dierogecko nehoueensis* (AMS R 166976) from Rivière Néhoué, Province Nord, New Caledonia, with particularly bold dorsal patterning. Photo by A.M. Bauer.



FIGURE 16. Life photograph of male paratype of *Dierogecko nehoueensis* (CAS 231863) from Dôme de Tiébaghi, Province Nord, New Caledonia with the borders of the dorsal stripe represented by a series of small dark-edged pale spots. Photo by A.H. Whitaker.

from posterodorsal margin of orbit to tail base, becoming thicker (approximately 5 granular scales in width) on head and nape and lumbar and sacral regions, and a narrower (2 granular scales in width) dark brown lateral stripe, more-or-less continuous, but interrupted in several places along the trunk. From lumbar region to tail base an additional thin (2–3 granular scales in width) dark brown stripe borders the cream stripe medially. Scattered dark pigment spots in wide middorsal stripe, especially posteriorly. A thick dark stripe from nostril to anterior and ventral margins of orbit, separated from supralabials by a narrow light brown border and bounded above by pale beige patch extending from supranasals to anterior of orbit and bisected by anterior extension of the yellowish-brown middorsal stripe. Area between ear and angle of jaw pale grayish-beige. Labials mottled brown with cream (pigmentless) spots near sutures. Iris opalescent with brownish reticulations. Limbs mid-brown with darker and lighter mottling; palms, soles and subdigital surfaces brown to grayish-brown. Dorsum of regenerated tail light brown with numerous irregular dark markings, especially posteriorly. Tail venter as dorsum, but with fewer dark markings. Venter buff with light scattering of brown pigment.

In life venter a mottled yellow.

VARIATION.—Comparative mensural data for the holotype and paratypes are given in Table 6. Meristic characters of paratypes are mostly similar to those of the holotype, and are mentioned hereafter if they differ. Original tails of CAS 231835 and 231836 114% and 106% of SVL, respectively. Two internasal scales in AMS R 161242, all other paratypes and non-types as holotype. Precloacal pores in male paratypes in two series, anterior row with 12 pored scales in continuous row (CAS 231836) or with a single poreless scale separating left and right series of 6 pored scales (CAS 231863). Posterior series with continuous row of 5 (CAS 231836) or 8 (CAS 231863) pores.

Dorsal patterning strongly demarcated, similar to holotype in AMS R 166976 (Fig. 15) and CAS 231836 and in juvenile non-types AMS R 166970 and CAS 231854–55. Original tail in CAS 231836 with narrow middorsal mid- to dark brown stripe paralleled by thicker cream stripes. These in turn bounded laterally by variably well developed narrow dark brown borders. Middorsal stripe lighter than flanks, but without striped cream or dark brown borders and original tail with series of contiguous gray-brown blotches on a dark brown background in CAS 231835. Dorsum nearly uniform with varying degrees of development of light brown punctations forming incomplete longitudinal dorsolateral lines (AMS R 161242–43) or with dark-bordered light spots forming distinct rows of ocelli (AMS R 161244, CAS 231864), sometimes contrasting strongly with the dorsal background (AMS R 161246, CAS 231863) (Fig. 16).

DISTRIBUTION AND NATURAL HISTORY.—This species is known from three localities on or in relatively close proximity to the ultramafic Dôme de Tiébaghi (599 m maximum elevation), both just north of Koumac in the far northwest of the Province Nord of New Caledonia (Fig. 3). These include a lowland site at the Rivière Néhoué, a mid-elevation (340 m) site on the western slopes of the massif near Paagoumène, and from two adjacent sites in the headwaters of the Fridoline catchment. The Rivière Néhoué locality comprises a flood-prone, lowland gallery (vallicole) forest on deep alluvial soil adjacent to the river at <10 m elevation (Fig. 17). The habitat is typified by a relatively complete canopy, sparse understory vegetation, deep leaf litter, and numerous logs and debris on the forest floor. Previous descriptions of this site have been published by Henkel and Böhme (2001) and Schröder and Röhl (2002). The vegetation of Tiébaghi has been discussed and illustrated by Holloway (1979). Maquis vegetation occurs on the lower slopes and a low dense forest association that is restricted to Tiébaghi occurs at higher elevations (Holloway 1979). The specimens from the upper valleys on the slopes of the Dôme de Tiébaghi were collected in dense closed forest, under stones by day and active foraging on subcanopy shrubs at night. Specimens from the Fridoline catchment (Fig. 18) were in tall maquis shrubland with *Gymnostoma* and at lower eleva-

tions (60–80 m) they were present in a narrow band of riparian forest along a stream bank. At mid-elevation they were found in low maquis. Most of those from Rivière Néhoulé were collected under logs on soil, but one (AMS R 166969) was active at night on a shrub. Two adult female specimens (CAS 231835, AMS R 166976) collected in late January are gravid and contain two eggs each.

At Néhoulé, *D. nehoulensis* cooccurs with a diverse herpetofaunal assemblage including *Bavayia* aff. *exsuccida*, *B.* aff. *cyclura*, *Eurydactylodes agricolae*, *Rhacodactylus chahoua*, *Lepidodactylus lugubris*, *Hemidactylus frenatus*, *Caledoniscincus* aff. *austrocaledonicus*, *C. aquilonius*, *C. festivus*, *Lioscincus nigrofasciolatus*, the newly described *Kanaksaurus viviparus*, and the introduced frog *Litoria aurea*. At Tiébaghi it is found with several of these species as well as *Rhacodactylus auriculatus* and *Caledoniscincus haplorhinus* (Whitaker et al. 2004).

CONSERVATION STATUS.—*Dierogekko nehoulensis* appears to be relatively common at all localities where it has been found. Although the difference in habitat suggests that it may be fairly catholic in its requirements and may occur in other patches of suitable habitat in the region, subsequent searches at a range of localities at low- to mid-elevation around the Dôme de Tiébaghi have so far failed to locate further populations. The known localities are impacted by a variety of threats. Potential introduced predators, including rats and cats, are present at all sites and the Rivière Néhoulé is also affected by pigs, cattle and deer (Whitaker Consultants Limited 2002; Whitaker et al. 2004). The Rivière Néhoulé site is one of few remaining gallery forest patches in the lowlands of north-western New Caledonia. The locality is currently administered as a recreational reserve, but the area is small and it experiences intensive human use. Further, Néhoulé has been invaded by the introduced ant *Wasmannia auropunctata* (Sadler et al. 2004), which is known to greatly reduce gecko abundance and has been associated with local extirpations of some lizard species (Jourdan et al. 2000, 2001). The isolated closed forest remnant on the western slopes of Dôme de Tiébaghi may be at risk from activities associated with nickel mining on the peak. Although the



FIGURE 17. Habitat of *Dierogekko nehoulensis* in low-land gallery forest at the type locality of Rivière Néhoulé, Province Nord, New Caledonia. Most specimens from this site were collected under logs on the ground. Photo A.H. Whitaker.



FIGURE 18. Habitat of *Dierogekko nehoulensis* in low maquis at Fridoline, Tiébaghi massif, Province Nord, New Caledonia. Photo A.H. Whitaker.

locality where *D. nehoueensis* was collected is not protected, two similar forested areas on the perimeter of the plateau have been set aside as botanical reserves. The species is here regarded as Endangered.

REMARKS.— The existence of this species was first noted by Henkel and Böhme (2001) who recorded the presence of *Bavayia validiclavis* at the type locality of *Eurydactylodes agricolae* ("circa 20 km north of Koumac, NW New Caledonia"), apparently at the Rivière Néhoué locality where our material was subsequently collected. A specimen of *D. nehoueensis* was also illustrated (as *B. validiclavis*, from "north of Koumac") by Seipp and Henkel (2000a, 2000b), and Schröder and Röhl (2002) also referred to *D. nehoueensis* from Néhoué as *B. validiclavis*.

***Dierogekko insularis* Bauer, Jackman, Sadlier, and Whitaker, sp. nov.**

Figures 19–22.

TYPE MATERIAL.— **HOLOTYPE:** MNHN 2004.0020 (formerly AMS R 161069): Adult male; New Caledonia, Province Nord, Îles Belep, Île Art, Wênè Cogat, northern plateau, 2 km E Waala, 19°42'52.7"S, 163°39'37.6"E (elevation 240 m), collected by A.H. Whitaker and V.A. Whitaker 23 May 2002. **PARATYPES:** AMS R 166971–72, CAS 231858: Adult male, CAS 231859: Adult female; New Caledonia, Province Nord, Île Yandé, Mariri [stream], 32 km NW Poum, 20°02'39.4"S, 163°47'43.4"E (elevation 20 m), collected by A.H. Whitaker and V.A. Whitaker, 7 October 2001. AMS R 161067, CAS 231865: Adult males; New Caledonia, Province Nord, Îles Belep, Île Pott, Pânan, 19°35'06.5" S, 163°35' 06.9"E (elevation 80 m), collected by A.H. Whitaker and V.A. Whitaker, 27 May 2002. AMS R 161075, CAS 231867–68: Adult males; same data as holotype.

ADDITIONAL MATERIAL.— AMS R166973–74, CAS 231856–57: same data as AMS R 166971. CAS 231866: same data as CAS 231865. AMS R 161070–71, CAS 231869: same data as holotype.

ETYMOLOGY.— The specific epithet *insularis* refers to the fact that this species is known only from islands in the far north of New Caledonia. These include Île Art and Île Pott in the Îles Belep, the northernmost ultramafic outliers of New Caledonia, and Île Yandé, NNW of Poum.

DIAGNOSIS.— *Dierogekko insularis* can be distinguished from all congeners on the basis of the following combination of characters: size intermediate (to 41.4 mm SVL), 1–2 internasal scales; distal subdigital lamellae divided; male preanal pores in one or two rows (anterior row 9–12, posterior row, when present, 1–8). Midvertebral region darker than remainder of dorsum, dark longitudinal borders of dorsal pale region well developed, beige stripes reduced to a series of spots.

DESCRIPTION (based on holotype).— Adult male. SVL 41.4 mm; TailL 49.6 mm (distal 19.8 mm regenerated). Head relatively short (HeadL/SVL ratio 0.27), relatively wide (HeadW/HeadL ratio 0.70), somewhat depressed (HeadH/HeadL ratio 0.40), weakly set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout relatively long (SnEye/HeadL ratio 0.42), blunt; longer than eye diameter (OrbD/SnEye ratio 0.63); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout larger than those on occipital region. Eye large (OrbD/HeadL ratio 0.27); pupil vertical with crenelated margins; supraciliaries short, bearing 3 elongate spines near posterodorsal margin of orbit. Ear opening oval, angled posterodorsally at an angle of 45° from horizontal, relatively large (EarL/HeadL ratio 0.14); eye to ear distance approximately same as diameter of eyes (EyeEar/OrbD ratio 0.99). Rostral much wider (2.1 mm) than deep (1.1 mm), incompletely divided dorsally. Two moderately enlarged supranasals separated by two pentagonal internasals. Rostral in contact with first supralabials, nostrils, supranasals and internasals. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals. At least four rows of small scales separate orbit from supralabials. Mental triangular, wider (1.2 mm) than deep (1.0 mm). Two enlarged (~16 times size of granular throat scales) irregular, polygonal postmentals separated by first infral-

abials from mental, bordered by first infralabials and posteriorly and posterolaterally by four enlarged chin shields each. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 9/8; total enlarged supralabials 11/10; supralabial scales to angle of jaws 15/13. Enlarged infralabials 10/10; infralabials to angle of jaws 12/14. Interorbital scale rows across narrowest point of frontal bone 17.

Body slender, moderately elongate (TrunkL/SVL ratio 0.40); no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales larger than dorsals, smooth, oval anteriorly to circular posteriorly, all with rounded free margins, subimbricate to imbricate, roughly uniform in size across venter. Approximately 137 scale rows around midbody. Gular region with homogeneous, smooth granular scales, equivalent in size to dorsal granules.

No enlarged precloacal or femoral scales; precloacal pores relatively small, in two adjacent angled series, anterior continuous row of 12 pores, posterior continuous row of four pores; no femoral pores. One enlarged, smooth, somewhat laterally projecting cloacal spur.

Scales on palm and sole smooth, rounded. Scalation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeaL/SVL ratio 0.13; CrusL/SVL ratio 0.14). Digits moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately twice size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and divided beneath distal phalanges (except terminal scansors). Scansors (terminal scansors of digit I not included in counts): 4–8–9–10–9 manus; 5–8–10–11–9 pes. Relative length of digits: IV>III>II>V>I (manus); IV>III~V>II>I (pes); interdigital webbing moderately developed between digits I–IV of pes, weakly developed between all digits of manus and absent



FIGURE 19. Holotype of *Dierogecko insularis* (MNHN 2004.0020) from Wênè Cògat, Île Art, Îles Belep, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.



FIGURE 20. Life photograph of *Dierogecko insularis* from Pânan, Île Pott, Îles Belep, Province Nord, New Caledonia, with very well-developed margins to the dorsal stripe and numerous darkly pigmented markings. Photo by A.H. Whitaker.



FIGURE 21. Life photograph of male paratype of *Dierogecko insularis* (CAS 231867) from Wênè Cògat, Île Art, Îles Belep, Province Nord, New Caledonia, with a distinctly pale vertebral stripe with a moderately well-developed border and no vertebral markings. Photo by A.H. Whitaker.



FIGURE 22. Life photograph of male paratype of *Dierogecko insularis* (AMS R 161075) from Wênè Cògat, Île Art, Îles Belep, Province Nord, New Caledonia, with a poorly differentiated vertebral stripe bordered by a series of pale spots rather than a continuous line. Photo by A.H. Whitaker.

between digits IV and V of pes. Partly regenerated tail longer than body length (TailL/SVL ratio 1.20), thick, slightly constricted at base, tapering gradually along distal half. No caudal tubercles; dorsal caudal scales squarish to oval, juxtaposed to subimbricate, eight rows per tail segment; subcaudal scales approximately 1.5 times larger than dorsals, rectangular with rounded free edges, more strongly imbricating.

Osteology: Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 12.5 post pygal caudal vertebrae proximal to regenerated portion of tail of holotype. Holotype and all other male specimens with one pair of crescentic cloacal bones present at level of second to third pygal vertebrae. Endolymphatic sacs not enlarged extracranially.

Coloration (in preservative): Dorsum medium brown with middorsal region slightly darker, demarcated by a pair of parasagittal series of faint beige spots (1–4 granular scales in width) with dark brown posterolateral borders. Series of marks most strongly developed on sacrum. Area from snout through eye to above ear slightly darker than remainder of head. Labials mid-brown with scattered small cream spots. Iris golden brown with black reticulations. Flanks and lateral borders of throat dappled with cream to beige spots. Limbs similar to dorsum but with lighter and darker brown mottling; palms, soles and subdigital surfaces brown to grayish-brown. Tail dorsum with very faint pattern of parasagittal light brown stripes with irregular borders; scattered dark brown scales irregularly distributed. Venter beige with scattered brown punctations on individual scales, pigmentation heaviest under limbs and on lateral margins of chin. Tail venter more-or-less uniform light brown with a few scattered mid-brown scales.

In life no dorsal markings were evident on AMS R 166972 or CAS 231858.

VARIATION.—Comparative mensural data for the holotype and paratypes are given in Table 7. Meristic characters of paratypes are mostly similar to those of the holotype, and are mentioned hereafter if they differ. One internasal scale in AMS R 166971, 166972, CAS 231858–59, and 231868. All paratypes with only a single postmental, ~8–20 times size of chin granules, variable in shape, contacting posterior apex of mental. Precloacal pores in male paratypes in two series (Îles Belep) or a single series (Île Yandé). Île Yandé male paratypes with 12 precloacal pores in a continuous series (CAS 231858) or separated by a single poreless central scale into series of 7 (left) and 5 (right) pores (AMS R 166972); Île Pott paratypes with pores arranged in adjacent continuous series of 10 and 1 (CAS 231865) or 12 and 8 (AMS R 161067); Île Art paratypes with pores arranged in adjacent continuous series of 12 and 1 (CAS 231867), 11 and 5 (CAS 231868), or 9 and 2 (AMS R 161075). Another Yandé male (non-type), CAS 231857, has two rows of precloacal pores, 13 and 5, demonstrating that a second row of pores occurs in some males on all three of the islands.

Dorsal pattern as in holotype, but with crown of head and middorsal stripe yellowish brown in AMS R 161067, AMS R 161075 (Fig. 21), CAS 231857 and CAS 231865. Others specimens paler overall with middorsal stripe and especially crown of head more yellowish, remainder of dorsum grayish-brown; longitudinal markings with faint cream borders on sides of head, lateral margins of middorsal stripe demarcated by beige spots without, or with weakly developed, dark brown borders. Dorsal pattern bold, with continuous medial cream stripes (1–4 granular scales in width) and lateral dark brown stripes (2–3 granular scales in width) bordering yellowish brown middorsal stripe in remaining specimens (Fig. 19). AMS R 161070 and CAS 231867 (Fig. 20) very dark overall, with light markings light brown rather than cream. Most specimens with a dark line from snout through eye to nape, especially well developed in CAS 231859, in which it contrasts strongly with the paler middorsal stripe and crown. Same paratype with a sagittal dark line extending from rostral to mid-dorsum of snout. Left side of middorsal and parasagittal markings interrupted around left shoulder

in AMS R 166971. Juvenile non-types variable in pattern: weakly developed in CAS 231856 (20.2 mm SVL), bold in AMS R 166973 (18.2 mm SVL). Original portions of tails in most specimens with a broad central cream line with dark brown lateral borders. Venter, especially chin, more heavily pigmented in AMS R 161070, CAS 231857, 231867 and 231869 than in holotype.

DISTRIBUTION AND NATURAL HISTORY.—

This species is known from the Îles Belep and Île Yandé (Fig. 3). Until recently both groups had been unexplored herpetologically. Jouan (1863, 1864) briefly discussed reptiles on the Îles Belep. A new genus and species of skink, *Kanakysaurus viviparus* (Sadlier et al. 2004) has recently been identified from the Belep islands and two sites on the New Caledonian mainland. In the Belep islands, *D. insularis* has been found on both Île Art (Aar) and Île Pott (Phwoc). The southernmost point of Île Art is approximately 45 km north of the northern tip of the Grande Terre, and Île Pott lies about 3 km north of Île Art, approximately 65 km from the Grande Terre. The specimens from Île Pott and Île Yandé were collected in maquis vegetation (Fig. 23) while those on Île Art were found in low, closed forest (Fig. 24). On Yandé, they were active at night on low bushes, exhibiting the characteristic nimbleness and agility of members of this genus (Whitaker Consultants Limited 2002). Two individuals from the Belep islands were found on an exposed clay bank (Whitaker et al. 2004). Paratype AMS R 166971, collected in October, 2001, contains two eggs.

At the type locality of Wênè Cogat *D. insularis* is sympatric with *Eurydactylodes agricolae*, *Rhacodactylus* aff. *chahona*, *R.* aff. *ciliatus*, *Caledoniscincus atropunctatus*, *C.* aff. *anstrocaledonicus*, *Kanakysaurus viviparus*, and *Lioscincus nigrofasciolatus*. At the paratype locality on Île Pott it co-occurs with *Bavayia* aff. *cyclura*, *Eurydactylodes agricolae*, *Hemidactylus garnotii*, *Caledoniscincus haplorhinus*, *Cryptoblepharus novocaledoniae*, and *Kanakysaurus viviparus*, while on Yandé it is sympatric with the first two skinks. In addition, several geckos and *Litoria aurea* are present in coastal localities on Yandé and *Phoboscincus garnieri* has been seen on Île Art (Whitaker et al. 2004).

CONSERVATION STATUS.— *Dierogekko insularis* is abundant in both closed forest and maquis habitats on the Îles Belep, occurring in groups of up to eight on single shrubs (Whitaker et al. 2004), but these the vegetation types are at risk from the relatively frequent wild fires (Sadlier et al. 2004). Introduced rats and feral cats are present on Yandé and in the Belep islands. Unlike at most mainland sites where predation is only suspected, cats on Yandé are documented to eat small lizards (Whitaker et al. 2004). Although absent from the maquis, fire ants (*Wasmannia auropunctata*) are established on Yandé in lowland secondary forest and are also present on Île Art and Île Pott, and they pose a potential threat to gecko populations. The species is here regarded as Endangered.



FIGURE 23. Habitat of *Dierogekko insularis* in maquis vegetation at Pânan, Île Pott, Îles Belep, Province Nord, New Caledonia. Photo A.H. Whitaker.



FIGURE 24. Habitat of *Dierogekko insularis* in closed forest at the type locality of Wênè Cogat, Île Art, Îles Belep, Province Nord, New Caledonia. Photo A.H. Whitaker.

Dierogecko poumensis Bauer, Jackman, Sadlier, and Whitaker, n. sp.

(Figs. 25–27)

TYPE MATERIAL.—HOLOTYPE: MNHN 2004.0021: Adult male; New Caledonia, Province Nord, Sommet Poupou, vicinity telecommunications tower, Poupou, 20°14'19"S, 164°01'56"E (elevation 200 m), collected by A.M. Bauer, R.A. Sadlier, T. Jackman, S.A. Smith and G. Watkins-Colwell, 25 January 2003. PARATYPES: AMS R 166977–78, CAS 231841, 231850, 231852: Adult males, AMS R 166979–80, CAS 231839, 231851: Adult females: same collection data as holotype.

ADDITIONAL MATERIAL.—AMS R 166981–89, CAS 231840, 231842–49, 231853, MCZ R 184130–33, MNHN 2004.0022–2004.0024, USNM 563360–61, YPM 15177–79: same collection data as holotype. AMS R 161205–07, CAS 231860–61: New Caledonia, Province Nord, Sommet Poupou, 3 km S Poupou, 20°15'44.2"S, 164°02'06.6"E (elevation 400 m), collected by A.H. Whitaker and V.A. Whitaker, 11 October 2001.

ETYMOLOGY.—The specific epithet *poumensis* refers to the occurrence of this species on Sommet Poupou, the northernmost of the northwest ultramafic peaks of the Grande Terre. It is roughly sympatric with *D. inexpectatus*.

DIAGNOSIS.—*Dierogecko poumensis* can be distinguished from all congeners on the basis of the following combination of characters: size small (to 38.3 mm SVL), 1 internasal scale; distal subdigital scansors typically undivided or incompletely divided; male preanal pores in a single row of 8–11. Crown of head mottled with beige spots, middorsal pale area bisected by irregular pale to mid-brown streak; cream and dark brown borders of dorsal pale region well demarcated; cream lines become bright white on sacrum or pygal portion of tail; original and regenerated tails typically with irregular yellowish- to rusty orange background wash.

DESCRIPTION (based on holotype).—Adult male. SVL 34.3 mm; TailL 35.3 mm (distal 28.1 mm regenerated). Head moderately short (HeadL/SVL ratio 0.30), relatively wide (HeadW/HeadL ratio 0.66), not depressed (HeadH/HeadL ratio 0.42), weakly set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout short (SnEye/HeadL ratio 0.35), blunt; longer than eye diameter (OrbD/SnEye ratio 0.64); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout larger than those on occipital region. Eye moderately large (OrbD/HeadL ratio 0.22); pupil vertical with crenelated margins; supraciliaries short, bearing 2 elongate spines near posterodorsal margin of orbit. Ear opening elliptical, angled posterodorsally at an angle of 45° from horizontal, moderately large (EarL/HeadL ratio 0.12); eye to ear distance greater than diameter of eyes (EyeEar/OrbD ratio 1.18). Rostral much wider (1.8 mm) than deep (0.8 mm), incompletely divided dorsally. Two moderately enlarged squarish supranasals separated by one large septagonal internasal. Rostral in contact with first supralabials, nostrils, supranasals and internasal. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals. At least four rows of small scales separate orbit from supralabials. Mental triangular, wider (1.2 mm) than deep (1.0 mm). A single enlarged (15–20 times size of granular throat scales) symmetrical, octagonal postmental bordered by mental, first infralabials, and five enlarged chin shields. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 7/7 total enlarged supralabials 9/8; supralabial scales to angle of jaws 13/14. Enlarged infralabials 9/8; infralabials to angle of jaws 12/11. Interorbital scale rows across narrowest point of frontal bone 16.

Body slender, elongate (TrunkL/SVL ratio 0.41); no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales slightly larger than dorsals, smooth, oval anteriorly to circular posteriorly, with rounded free margins, subimbricate to imbricate, roughly uniform in size across venter. Approximately 128 scale rows around midbody. Gular region with homogeneous, smooth

granular scales, equivalent in size to dorsal granules.

No enlarged precloacal or femoral scales; precloacal pores relatively small, in single continuous angled series of 11; no femoral pores. One (right) or two (left) enlarged, smooth, conical, somewhat laterally projecting cloacal spurs.

Scales on palm and sole smooth, rounded. Scalation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeaL/SVL ratio 0.13; CrusL/SVL ratio 0.16). Digits moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately twice size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and undivided or incompletely divided beneath distal phalanges. Scansors (terminal scansors of digit I not included in counts): 4–7–10–10–9 manus; 4–9–11–11–9 pes. Relative length of digits: IV>III>II>V>I (manus); IV>III~V>II>I (pes); interdigital webbing moderately developed between all digits of manus and digits I–IV of pes, absent between digits IV and V of pes. Mostly regenerated tail approximately equal to body length (TailL/SVL ratio 1.03), thick, slightly constricted at base, tapering gradually along distal $\frac{1}{3}$. No caudal tubercles; dorsal caudal scales squarish to rectangular with rounded free margins, juxtaposed to submibricate, eight rows per tail segment; subcaudal scales rectangular, approximately 1.5 times larger than dorsals, more strongly imbricating.

Osteology: Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 6.5 post pygal caudal vertebrae proximal to regenerated portion of tail of holotype (12.5 post-pygal vertebrae to point of regeneration in paratype with longest original tail, CAS 231851). Male paratypes with one pair of crescentic cloacal bones present, flared posterolaterally, at level of second to third pygal vertebrae. Endolymphatic sacs not enlarged extracranially.

Coloration (in preservative): Mid-brown with a slightly lighter middorsal stripe mottled with beige spots, especially on the crown of the head. Middorsal stripe paralleled by a pair of parasagittal pale stripes from supranasals to tail, beige on trunk, but white from posterior of orbit to level of occiput and on sacrum and tail base. Middorsal stripe bisected on trunk by an irregular pale to mid-brown stripe. Beige to white parasagittal stripe bordered laterally by a more-or-less continuous dark brown border; a more incomplete dark brown border medially. Thick dark stripe from nostril through eye to above ear, continuous with lateral border of pale parasagittal stripe. Labials with alternating pattern of mid- to dark brown and cream. Flanks mottled grayish-brown. Limbs similar



FIGURE 25. Holotype of *Dierogekko poumensis* (MNHN 2004.0021) from Sommet Poupou, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.



FIGURE 26. Life photograph of *Dierogekko poumensis* from Sommet Poupou, Province Nord, New Caledonia, with bold dorsal markings. As is typical for this species, the markings at the tail base are bright white and the tail has orangish markings. Photo by A.H. Whitaker.

to upper flanks and mottled with lighter and darker markings; palms, soles and subdigital surfaces brown to grayish-brown. Pale parasagittal stripes well defined on tail base, with dark borders; pattern fading rapidly distally along tail. Regenerated portion of tail mottled light to mid-brown. Venter beige with many scattered dark brown scales, pigmentation heaviest under limbs, around cloaca and on throat, which has a marbled appearance. Venter of both original and regenerated portions of tail an uneven grayish-brown.

VARIATION.—Comparative mensural data for the holotype and paratypes are given in Table 8. Body size ranged from 24.3 mm (AMS R 166982, juvenile non-type) to 38.3 (female paratype CAS 231841). Mostly original tail of CAS 231850 is 107% of SVL. Meristic characters of paratypes are mostly similar to those of the holotype. Precloacal pores in male paratypes in a single continuous series of 8 (AMS R 166978), 10 (CAS 231850, 231852), or 11 (AMS R 166977).

Color pattern is relatively uniform among the large series of specimens examined. The pale lines on the sacrum are almost always bright white (Figs. 25–26). The pale middorsal stripe is somewhat less-well demarcated than in the holotype in AMS R 166988–89, AMS R 161205, CAS 231848, USNM 563361, and YPM 15178. MCZ R 184132 and AMS R 166989 have somewhat less heavily pigmented venters than the holotype. Tail of juvenile specimen AMS R 166982 distinctly orange-red in life. Whitaker Consultants Limited (2002) noted the orange tint of tails of this species (Fig. 25) and also suggested that the tail was thickened relative to other *Dierogekko* species.

DISTRIBUTION AND NATURAL HISTORY.—This species is known only from Sommet Poupou (414 m maximum elevation) (Fig. 3). Its distribution over the massif appears patchy but it is known from several localities from the vicinity of the town of Poupou in the north to Canne Stream on Sommet Sud in the south. All sites are in maquis shrubland (Fig. 28), from elevations of 10 m to the highest levels of the summit plateau. The large series was collected in a span of about two hours. All animals collected with the types were active on low (approximately 1m) maquis shrubs along the service track to the telecommunications tower on the north slope of Sommet Poupou (Fig. 29). As many as five geckos were active on a single plant. Animals appeared to be actively foraging on the twigs and foliage when captured. When approached closely some geckos dropped to the base of bushes as has been reported for roosting chameleons (Parcher 1974). Many females contained two eggs including the largest specimens examined, paratype CAS 231841, as well as non-types AMS



FIGURE 27. Life photograph of *Dierogekko pounensis* climbing on a maquis shrub at Sommet Poupou, Province Nord, New Caledonia. This specimen is weakly patterned but still clearly exhibits the bright white markings on the tail base. Photo by T. Jackman.

R 166986–87, CAS 231844 and YPM 15179, collected in January 2003, and AMS R 161205–06 and CAS 231860, collected in October 2001.

Dierogecko pommensis is syntopic with *Eurydactylodes agricolae* and another new species of *Dierogecko* (see below) on the plateau of Sommet Poup, and with *Oedodera marmorata* and *Hemidactylus frenatus* at the low elevation sites. Other sympatric taxa include *Cryptoblepharus novocaledonicus* and an unidentified *Caledoniscincus*, as well as a large skink, possibly *Phoboscincus garnieri*, in maquis on top of the massif, and the common lowland species (*Caledoniscincus atropunctatus*, *C. aff. austrocaledonicus*, *C. haplorhinus*, *Lioscincus nigrofasciatus*) occur near sea-level on the lower slopes of the mountain (Whitaker et al. 2004).

CONSERVATION STATUS.—*Dierogecko pommensis* is extremely common at its type locality and occurs in lesser abundance at other sites on the massif. However, the total area of Sommet Poup is small and populations of *D. pommensis* are patchy. A nickel mine is currently being operated at the northern end of the massif and there are plans to extend the pit to the summit plateau. Wild fires are a relatively frequent occurrence and since 2001 a fire has destroyed a large area of maquis on the plateau where these geckos were formerly common. An added threat is that fire ants have recently established in closed forest remnants on the plateau with a consequent decimation of gecko populations (Jourdan et al. 2000, 2001). Both introduced rats and feral cats occur on Sommet Poup, but as on most northwestern peaks, direct evidence of gecko predation is lacking (Whitaker et al. 2004). Given the highly restricted known range of this species and serious threats to its habitat, we regard it as Critically Endangered.

***Dierogecko inexpectatus* Bauer, Jackman, Sadlier, and Whitaker, sp. nov.**

Figures 30–31.

TYPE MATERIAL.—HOLOTYPE: MNHN 2004.0025 (formerly AMS R 161222): Adult female; New Caledonia, Province Nord, Sommet Poup, Paévala, 2 km S Poup, 20°15'05.6"S, 164°01'22.4"E (elevation 320 m), collected by A.H. Whitaker and V.A. Whitaker 15 October 2001.

ETYMOLOGY.—The species name *inexpectatus* means unexpected and refers to the occurrence of this second species of *Dierogecko* from the small, relatively low elevation Poup Massif. When originally discovered it was not recognized as being distinct from the smaller *D. pommensis* (Whitaker Consultants Limited 2002).



FIGURE 28. Maquis shrubland on the plateau of Sommet Poup, Province Nord, New Caledonia. Photo by A.H. Whitaker.



FIGURE 29. Maquis shrubs at type locality of *Dierogecko pommensis* near the telecommunications tower at approximately 200 m elevation, Sommet Poup, Province Nord, New Caledonia overlooking Île Mouac (left) and Île Tuany (right) off the northwest coast of the Grande Terre. As many as five individuals were found in a single shrub. Photo by A.M. Bauer.

DIAGNOSIS.—*Dierogekko inexpectatus* can be distinguished from all congeners on the basis of the following combination of characters: size relatively small (39.5 mm in unique type), three internasal scales; distal subdigital lamellae divided; [male preanal pore condition unknown]. Cream stripes uniform on dorsum, becoming wider on tail base; small cream spots on area between forelimb insertion and loreals.

DESCRIPTION (based on holotype).—Adult female. SVL 39.5 mm; TailL 36.2 mm (distal 25.8 mm regenerated). Head relatively short (HeadL/SVL ratio 0.27), wide (HeadW/HeadL ratio 0.68), somewhat depressed (HeadH/HeadL ratio 0.39), weakly set off from relatively thick neck. Loreal region without inflated canthal area; interorbital region slightly depressed. Snout moderately elongate (SnEye/HeadL ratio 0.44), blunt; much longer than eye diameter (OrbD/SnEye ratio 0.54); scales on snout and forehead small, rounded, granular to weakly conical, homogeneous; scales on snout much larger than those on occipital region. Eye relatively large (OrbD/HeadL ratio 0.24); pupil vertical with crenelated margins; supraciliaries short, bearing three elongate spines near posterodorsal margin of orbit. Ear opening elliptical, angled posterodorsally at an angle of 45° from horizontal, large (EarL/HeadL ratio 0.14); eye to ear distance greater than diameter of eyes (EyeEar/OrbD ratio 1.20). Rostral wider (1.7 mm) than deep (1.1 mm), incompletely divided dorsally. Two moderately enlarged supranasals separated by three internasals, one anterior and two posterior. Rostral in contact with first supralabials, nostrils, supranasals and all three internasals. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial, nasal and two postnasals. At least four rows of small scales separate orbit from supralabials. Mental triangular, wider (1.2 mm) than deep (1.0 mm). A single enlarged (15–20 times size of granular throat scales) hexagonal postmental, anterior apex narrowest, bordered by mental, first infralabials, and four enlarged chin shields, two posteriorly and one each posterolaterally. Two to three scale rows posterior to postmental and medial to infralabials enlarged relative to remainder of chin and throat scales. Supralabials to midorbital position 8/7; total enlarged supralabials 10/10; supralabial scales to angle of jaws 14/14. Enlarged infralabials 8/8; infralabials to angle of jaws 11/13. Interorbital scale rows across narrowest point of frontal bone 17.

Body slender, elongate (TrunkL/SVL ratio 0.44) no ventrolateral folds. Dorsal scales smooth, granular, homogeneous. Ventral scales larger than dorsals, smooth, hexagonal and subimbricate to imbricate, roughly uniform in size across venter. Approximately 151 scale rows around midbody. Gular region with homogeneous, smooth granular scales, equivalent in size to dorsal granules. No



FIGURE 30. Holotype of *Dierogekko inexpectatus* (MNHN 2004.0025) from Paevala, Sommet Poum, Province Nord, New Caledonia. Scale bar = 10 mm. Photo by A.M. Bauer.



FIGURE 31. Life photograph of holotype of *Dierogekko inexpectatus* (MNHN 2004.0025) from Paevala, Sommet Poum, Province Nord, New Caledonia. Photo by A.H. Whitaker.

enlarged precloacal or femoral scales; no precloacal or femoral pores. No enlarged cloacal spurs.

Scales on palm and sole smooth, rounded. Scallation on dorsal surfaces of limbs similar to body dorsum. Fore and hindlimbs short and thick (ForeaL/SVL ratio 0.12; CrusL/SVL ratio 0.14). Digits moderately dilated; claws well developed and recurved on digits II–V; claw much reduced and less strongly recurved on digit I, situated between asymmetrical distal pads (lateral pad approximately twice size of medial). Basal subdigital lamellae broad, rectangular, becoming bowed distally and angled and divided beneath distal phalanges (except for terminal scansors). Scansors (terminal scansors of digit I not included in counts): 6–9–12–12–9 manus; 6–10–12–11–9 pes. Relative length of digits: IV>III>I>V>II (manus); IV>III~V>II>I (pes); interdigital webbing moderately well developed between all digits of manus and digits I–IV of pes. Regenerated tail shorter than SVL (TailL/SVL ratio 0.92), thick, slightly constricted at base, tapering sharply along distal 1/3. No caudal tubercles; dorsal caudal scales rectangular, juxtaposed, eight rows per tail segment; subcaudal scales larger than dorsals.

Osteology; Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 4.5 post pygal caudal vertebrae in original tail of holotype. Endolymphatic sacs not enlarged extracranially.

Coloration (in preservative): Dorsal ground color brown, with a pair of thin (2–3 granular scales in width), cream, parasagittal stripes extending from posterodorsal margin of orbit on to tail base; stripes relatively uniform on dorsum, becoming thicker and less well defined on original portion of tail. Stripes bordered by narrow (1–2 granular scales in width) dark brown margins, more well developed laterally than medially. Vertebral area lighter than dorsum lateral to stripes. Area in front of forelimb insertion and below cream stripe as far anterior as loreal region darker brown than dorsum, with scattered, small, irregular cream colored spots. Labial scales mid- to dark brown with cream gaps bracketing sutures between scales. Iris blackish. Flanks light brown. Limbs mottled; palms, soles and subdigital surfaces brown to grayish-brown. Regenerated portion of tail midbrown with irregular darker markings, some longitudinally oriented. Venter beige with scattered small, dark punctations on individual scales; chin mottled. Tail venter light brown, with relatively uniform brown pigment flecks across all scales; scattered larger dark brown markings irregularly distributed. Venter of regenerated portion of tail becoming darker distally.

DISTRIBUTION AND NATURAL HISTORY.— This species is known from a single specimen collected beneath a stone in deep leaf litter in closed forest at Paevala (320 m) on Sommet Poupou, at the far northwest of the Grande Terre (Fig. 3). *Dierogecko inexpectatus* cooccurs with its congener *D. poumensis*. Other reptile species occurring on Sommet Poupou are listed under the account of the latter species.

CONSERVATION STATUS.— As only a single individual of this species was collected, despite the large number of *D. poumensis* found, it is possible that *D. inexpectatus* may be very limited in its distribution. Although it may occur nearby in unsampled areas it has not been found during searches of any other localities and a recent resurvey of the type locality failed to find further individuals. The threats facing lizard populations on Sommet Poupou (mining, wild fires, fire ants, introduced mammalian predators) have been discussed under *D. poumensis*. We provisionally regard *D. inexpectatus* as Critically Endangered, but further data are required to assess the real threats to its survival.

COMPARISONS AMONG SPECIES

As noted in the introduction, *Dierogecko* spp. are highly conservative in morphology, and differ little in most respects. All species can be unambiguously diagnosed on the basis of mtDNA data,

but no single morphological features have been identified that will serve to distinguish them. Even the few putatively diagnostic combinations of features must be considered as provisional in that they will only serve to distinguish the species based on the degree of variation known to exist in the specimens available. Sample sizes, however, are small for most species and larger samples might reveal more extensive overlap in features such as size and preanal pore counts. In practice, species of *Dierogekko* are most easily assigned to species on the basis of locality. Only on Sommet Poupou do two species occur in sympatry (*D. poumensis*, *D. inexpectatus*). The former species may be distinguished from the latter by its smaller size (maximum 38.32 mm SVL versus 39.48 mm SVL for the unique type of *D. inexpectatus*), undivided or incompletely divided subdigital scansors, and single internasal scale (versus 3 internasals). Unfortunately, the male of *D. inexpectatus* is unknown, so the preanal pore condition for this species is undetermined.

For the seven species for which males are known, three species possess two rows of preanal pores (*D. thomaswhitei*, *D. validiclavis*, *D. nehoueensis*) and three have only a single row of pores (*D. kaalaensis*, *D. koniambo*, *D. poumensis*). *Dierogekko insularis* is variable in this regard and may have from zero to eight pores in a posterior row of pores. Although all species are small in absolute terms, they segregate into several categories of maximum body size: *D. kaalaensis*, *D. thomaswhitei* and *D. validiclavis* all reach SVLs of approximately 45 mm. Excluding *D. inexpectatus* (known only from a single specimen), most of the remaining species reach a maximum size of 41–43 mm, whereas *D. poumensis*, for which a large sample is available, barely exceeds 38 mm SVL. Finally, the species do differ subtly in color pattern, although there is considerable variation in some taxa (see individual species diagnoses and life photographs).

DISCUSSION

PHYLOGENY OF *DIEROGEKKO*.— Relationships within *Dierogekko* are well supported by ND2 sequence data. As expected, the more slowly evolving RAG-1 gene contributes less to intrageneric resolution, but is fully consistent with the ND2 data. The basal division in the genus separates *D. poumensis* from all remaining taxa (Fig. 32). Based on the Bayesian analysis *D. validiclavis* and *D. inexpectatus* are sister species, with *D. nehoueensis* the sister group to this pair. This cluster as a whole forms the sister group to (*D. insularis* (*D. koniambo* (*D. kaalaensis*, *D. thomaswhitei*)). Under parsimony *D. insularis* forms a trichotomy with the other two clades in a strict consensus of equally parsimonious trees. Each of the individual species receives strong support (Bayesian posterior probability 1.00, 100% bootstrap support) and all supraspecific groupings, except that clustering *D. insularis* with the Koniambo/Taom/Kaala clade, are supported by posterior probabilities of at least 0.99. With respect to mainland species, the phylogeny is geographically coherent. The northernmost taxon (*D. poumensis*) is the sister group to a northern ultramafics plus northeastern (*validiclavis* sensu stricto) clade plus a southern ultramafic clade.

Within *D. insularis*, the Île Art population is the sister group to that from Île Pott, with Île Yandé outside of this. In other taxa represented by more than one locality (*D. kaalaensis*, *D. validiclavis*) specimens from each locality are reciprocally monophyletic. The exception is *D. nehoueensis*, in which there is almost no differentiation between samples from Néhoué and nearby Tiébaghi.

AGE OF THE *DIEROGEKKO* RADIATION.— A comparative analysis of the New Caledonian and New Zealand skink and gecko fauna suggests that all of the within-island speciation in both taxonomic groups occurred approximately 30 million years ago (Jackman, 2005; Jackman and Bauer, in prep), following the maximal extent of the Oligocene marine transgression, which reduced New Zealand to an area of about 18% of its current aerial land mass (Cooper and Millener 1993). This transgression is believed to have resulted in the Oligocene bottleneck, which reduced genetic and

phyletic diversity in New Zealand and is thought to have been important in the evolutionary history of many animal taxa, including insects, birds, and lizards, at least in New Zealand (Cooper and Cooper 1995; Hickson et al. 2000; Chambers et al. 2001; von Dohlen and Teulon 2003; Trewick and Morgan-Richards 2005; although its impact on the flora remains to be substantiated, Lee et al. 2001). Comparable influence of Oligocene transgressions on the biotic history of New Caledonia has been suggested (Bauer 1999), but has not been previously demonstrated, and other Tertiary events, particularly the Eocene ophiolitic obduction, have been proposed as important events (Lowry 1998; Lee et al. 2001).

Assuming a 30 million year old time to common ancestry for the most divergent lineages of New Caledonian diplodactylid geckos and using the program r8s to calibrate the ages of divergence for the ND2 data, the estimated time to common ancestry of the genus *Dierogekko* is 19.2 million years. Using the same calibration, the most recent speciation event in the genus is 5.7 million years. A somewhat independent estimate of the same ages using a rate of 0.65% change per lineage per million years based on a variety of reptile and amphibian lineages (Macey et al. 1998; Weisrock et al. 2001) gives estimates of 18.6 and 10.1 million years for the age of the genus and the most recent speciation event. As a whole, the *Dierogekko* clade is roughly the same age as the *Bavayia cyclura* group, but older than the *Bavayia sauvagii* group.

These age estimates are in sharp contrast to those found by Murienne et al. (2005) for the New Caledonian cockroach genus *Angustonicus*. These authors argued that diversification in this lineage was no older than two million years and used this to support a broader hypothesis that the biotic richness and endemism of New Caledonia are not necessarily reflective of a Gondwanan origin of the indigenous taxa. While we agree that much of the modern New Caledonian biota owes its diversification to Tertiary events, we believe that the young age of the *Angustonicus* radiation is not typical of the fauna as a whole. Rather, our data suggest that events from the mid-Tertiary onwards have played a role in the cladogenesis of the diplodactylid geckos of the region. Although some reconstructions suggest that all of New Caledonia was submerged during the Paleocene (Murienne et al. 2005), thus necessitating a dispersalist origin for all land biota, evidence from the flora suggests that some land area existed even during periods of maximal obduction and transgression (Lowry 1998). Further, rough dating of the divergence between New Caledonian and New Zealand diplodactylids, as well as that between those lineages and Australian diplodactylids, is consistent with cladogenesis associated with Late Cretaceous to Early Tertiary geological events occurring

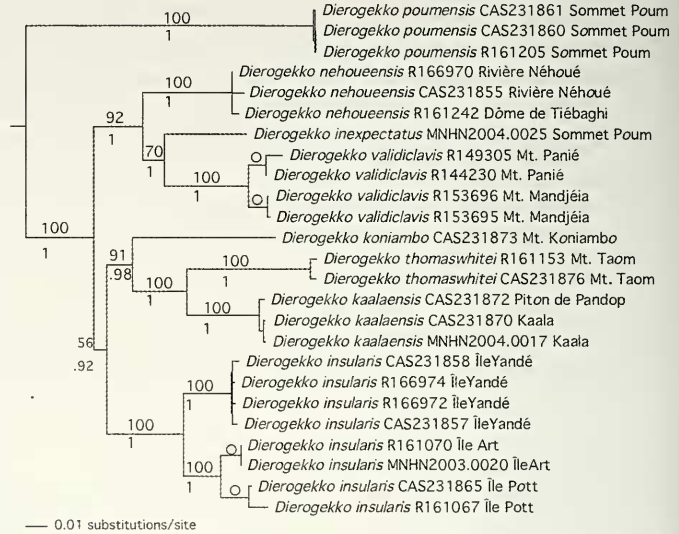


FIGURE 32. Maximum-likelihood tree under the GTR + I + G model. Bootstrap values are presented above the branches and posterior probability values are below the branches. This topology is one of the 3 most parsimonious trees. Branches are proportional to length using Maximum-likelihood. Outgroups are not shown. Short branches with bootstrap values over 95% and posterior probabilities of 1 are indicated with a dot. Specimens without institutional codes indicated are all from the Australian Museum (AMS).

along the eastern margin of Gondwanaland (Jackman 2005). Thus, we follow Bauer (1990, 1999) in considering the New Caledonian diplodactylid fauna to be Gondwanan in origin, although it is now clear that the “modern” radiation of taxa is more recent and consistent with the Oligocene bottleneck hypothesis. A similar extinction followed by radiation of remaining taxa has been postulated to explain the history of the New Caledonian flora as well (Jaffré et al. 1987).

BIOGEOGRAPHY.—*Dierogekko* is restricted to the northern portion of New Caledonia and to islands that were once connected to the New Caledonian mainland. Specifically, they occur allopatrically in association with a series of isolated ultramafic massifs northwest of the Grande Terre. This chain of ultramafics extends from the Massif du Boulinda (1330 m) in the south, through the Massif de Kopéto (1083 m), the Massif de Koniambo (940 m), the Massif d'Ouazangou-Taom (1092 m), Mont Kaala (1079 m), Dôme de Tiébaghi (599 m), and Sommet Poum (414 m), to the Îles Belep in the far north (Sautter 1981; Jaffré et al. 1987; Morat 1993). Indeed all of the isolated peaks from Koniambo north, except Ouazangou, which has not been sampled, support endemic species of *Dierogekko*. Only *D. validiclavis* sensu stricto occurs entirely outside the ultramafic massifs, being restricted to the metamorphic rocks of the Panié Massif in the northeast of New Caledonia. In addition, *D. nehoueensis* occurs in the lowland riverine Néhoué Valley, adjacent to the Dôme de Tiébaghi, where it is present on an alluvial substrate.

Ultramafic rocks include peridotites and serpentinites, which are composed of magnesium silicates containing iron, nickel, cobalt and manganese. They give rise to lateritic soils that are poor in potassium, calcium and phosphorus and rich in heavy metals (Ni, Mn and Co) (Jaffré et al. 1994, Lowry 1998). The ultramafic massifs are substantially drier than the axial ranges of metamorphic rock that parallel them to the east (Paris 1981; Sautter 1981), and they support a rich and distinctive flora (Jaffré 1974; Jaffré and Latham 1974). They are mostly covered by maquis shrubland characterized by evergreen shrubs and also support a high diversity of sedges (Cyperaceae). Elevations above 700 m are typically dominated by species of *Costularia*, *Hibbertia*, *Knightia*, *Dicranopteris*, *Galmia*, and *Grevillea* (Jaffré 1974; Jaffré and Latham 1974), although small and highly fragmented humid forest patches also remain despite often intensive mining activity. These may be dominated by podocarps or lauraceous trees, or by species of *Casuarina*, *Metrosideros*, *Nothofagus*, or *Araucaria* (Jaffré 1980; Morat et al. 1986; Jaffré et al. 1987). Plant diversity is especially high in these regions, with more than 1800 species or more than 60% of the New Caledonian flora. Further, of these, 98% are New Caledonian endemics and at least 1176 species are restricted to ultramafics. The dominant vegetation in much of the ultramafic regions is maquis vegetation. The maquis has approximately 1150 species, of which almost 90% are endemic (Jaffré et al. 1994, 2001). More specifically, each of the northwestern ultramafic massifs is associated with endemic plants (Jaffré et al. 1987).

By the late Eocene peridotites, the most widespread of the ultramafic substrates, covered virtually all of New Caledonia (Guillon 1975; Jaffré et al. 1987, 1994). Now they cover much of the southern third of New Caledonia as well as the Île des Pins off the southern coast and numerous northern isolates, including the Belep islands, which together constitute the Ophiolitic Nappe (Cluzel et al. 2001). Ultramafics have been implicated in both the major extinction and subsequent radiation of the flora (Jaffré et al. 1987, 1994). Since the end of the Eocene, erosion has reduced and fragmented this previously continuous substrate (Guillon 1969, 1975; Trescases 1969, 1975; Guillon and Routhier 1971), and it is possible that such fragmentation may be associated with cladogenesis in *Dierogekko*. However, there have also been significant climatic and vegetational changes in New Caledonia during this period (Lowry 1998; Lee et al. 2001) and specific candidate cladogenetic events remain elusive.

In contrast to earlier interpretations of the New Caledonian fauna (e.g., Diamond 1984), it now

appears that New Caledonia has been the site of numerous in situ radiations of vertebrate taxa (Bauer 1989; Bauer and Sadlier 1993, 2000). Indeed, animals and plants of many groups exhibit significant radiations within New Caledonia (e.g., Haase and Bouchet 1998; Eibl et al. 2001). The fauna of the northwestern ultramafics has been poorly studied to date. Putatively endemic scarabid beetles have been reported from the Îles Belep (Paulian and Pluot-Sigwalt 1984). Unfortunately, explicit phylogenetic hypotheses are lacking for all of these groups, so it is not yet possible to apply cladistic biogeographic methods (Humphries and Parenti 1999) to test hypotheses of area relationship among the isolated peaks.

CONSERVATION.— All of the new species of *Dierogecko* face threats from habitat destruction and from predation or harassment from introduced animals. Introduced mammals, in particular, have been demonstrated to have negative impacts on the New Caledonian native biota in general (Gargomigny et al. 1996) and most such species have successfully invaded even the most remote, high-elevations of the island (Rouys and Theuerkauf 2003). Rats and cats are the most frequently encountered introduced mammals in *Dierogecko* habitats. Both have been known to cause local lizard extirpation or to decrease population densities (Whitaker 1978; Newman 1994) and rats may also alter habitats through their differential consumption of seeds and young plants (Campbell and Atkinson 1999, 2002). Habitat destruction or alteration is also caused by deer (*Cervus timorensis*) and pigs (*Sus scrofa*), both of which are present at most of the sites where *Dierogecko* spp. have been collected. The gecko *Hemidactylus frenatus* has been known to competitively exclude other gecko species in areas where it has been introduced (e.g., Petren et al. 1993, Petren and Case 1996; Cole et al. 2005). *Dierogecko* spp. populations are presently known to occur syntopically with *H. frenatus* at several localities and they may be a threat to another newly described New Caledonian gecko, *Oedodera marmorata* (Bauer et al. 2006). Given the successful spread of *H. frenatus* elsewhere in New Caledonia (Bauer and Sadlier 2000), we consider it a potential threat to those populations of *Dierogecko* occurring at lower elevations. The fire ant, *Wasmannia auropunctata*, was encountered sympatrically with only one of the mainland *Dierogecko* sites (Rivière Néhoulé), but it does occur on Yandé and the Îles Beleps, and at Mt. Taom it has been recorded from lower elevations (Whitaker et al. 2004). This invasive species is highly competitive with other ants and is widespread in New Caledonia (Le Breton et al. 2003). It is known to impact negatively native geckos (Jourdan et al. 2001) and must also be considered a potential threat.

Probably the greatest threat to *Dierogecko*, however, is from wholesale habitat destruction. Although *D. validiclavis* receives a measure of protection on the Massif de Panié, the species occurring in the northwest of New Caledonia are all subject to major habitat alteration, chiefly from mining operations. Operational mines are present on Taom, Kaala, the Dôme de Tiébaghi and Sommet Poum, and a large new mine is planned for Koniambo. Past mining activities have altered landscapes and vegetation at the island localities and wild fires pose a significant threat at all sites (Sadlier et al. 2004; Whitaker et al. 2004). Finally, although the Rivière Néhoulé site has some protection as a recreational park, this very use opens the area up to further degradation, both through direct human activity, but also through the intentional or inadvertent introduction of non-native animals, including cattle and fire ants.

We have modified IUCN criteria (1996) for assigning taxa to risk categories, relying on estimated distribution in combination with known or perceived threats, where area of occupancy has been adjusted for the total area of New Caledonia (Sadlier and Bauer 2003; Sadlier et al. 2004). A species represented by 5 or fewer site records (2.5% or less of total landmass, where each site record represents a potential maximum area of 100 km² and reflects the potential maximum degree of population fragmentation) is considered Endangered dependent upon the degree of fragmentation in the presence of threats to the area of occupancy or extent and quality of habitat. Critically Endangered

species are those known from a single location of < 100 km² and exposed to diminishing habitat area and/or quality due to actual habitat loss or introduced predators (Sadlier and Bauer 2003; Whitaker et al. 2004). On this basis *Dierokekko thomaswhitei*, *D. kaalaensis*, *D. poumensis*, *D. inexpectatus* and *D. koniambo* are Critically Endangered and *D. nehoneensis* and *D. insularis* are Endangered. *Dierokekko validiclavis*, while occurring at only two sites (Mt. Panié and Mt. Mandjélia) is considered Vulnerable rather than Endangered because of the large extent and potential habitat for it that has yet to be surveyed (Sadlier and Bauer 2003).

Whitaker et al. (2004) proposed that protection should be given to all remaining high elevation closed forest patches on ultramafic substrates in New Caledonia and that high elevation maquis should also be considered of high conservation value. They also suggested that mammal eradication programs, such as those implemented successfully in New Zealand (Towns et al. 1997; Towns and Broome 2003) could be put in place for the northern islands of New Caledonia, including Île Yandé, Île Art, and Île Pott. While the limited distributions of all species of *Dierokekko* will always leave them vulnerable to habitat perturbations, actions such as these would do much to decrease risk levels to populations.

The recognition of seven new species and of the distinctiveness of these species as a group from other New Caledonian diplodactylid geckos serves further to highlight both the species richness and phyletic diversity of the New Caledonian herpetofauna. Both of these concepts had been grossly underestimated for many years, due to inadequate collecting and general inattention by systematists (Bauer 1989). Recent intensive work coupled with extensive sampling, and a paradigm shift to lineage-based species concepts (de Queiroz 1998; Brown and Diesmos 2001), have demonstrated that the New Caledonian herpetofauna exhibits a high degree of intra-island or microendemism (Bauer and Sadlier 1993, 2000; Bauer 1999). Specifically, the southern ultramafic block of New Caledonia, along with the Panié massif and several karst areas had been identified as localized areas of reptile endemism. The exploration of the northwestern ultramafic peaks and surrounding areas in northern New Caledonia (Whitaker Consultants Limited 2002; Whitaker et al. 2004) has revealed staggering levels of microendemism, with locally or strictly endemic skinks and/or geckos on each of the ultramafic peaks extending from Boulinda in the south to the Îles Belep in the north. Further endemism has been recognized even from lowland sites in the northwest of the island (Bauer et al. 2006). These results further emphasize the uniqueness and conservation priority of New Caledonia (Myers 1988, 1990; Chazeau 1993; Mittermeier et al. 1996, 1999; Myers et al. 2000; Lowry et al. 2004).

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TABLE 1. Primers used in this study. Primers are designated by their 3' ends, which correspond to the position in the human mitochondrial genome (Anderson et al. 1981). H and L designate primers whose extension produces the heavy and light strands, respectively.

<i>Human position</i>	<i>Gene</i>	<i>Sequence</i>	<i>Reference</i>
L4419	tRNAMet	5'-AAGCAATTGGGCTCATACC-3'	Macey et al. (1997)
L5002	ND2	5' CAAACACAAACCCGAAAAAT-3'	This Study
H5140	ND2	5'-CCYAGGTCTAAGAGGGTTTTTG-3'	This Study
H5617b	tRNAAla	5'-CTGAATGCAACTCAGACACTTT-3'	Macey et al. (1997)
H5934	COI	5'-AGRGTGCCAATGTCTTTGTGRTT-3'	Macey et al. (1997)

TABLE 2. Museum Vocher Numbers and Corresponding GenBank accession numbers.

<i>Species</i>	<i>Museum Voucher Number</i>	<i>Genbank Locality</i>
<i>Dierokekko poumensis</i>	AMS R 161205	Sommet Poum
<i>Dierokekko poumensis</i>	CAS 231860	Sommet Poum
<i>Dierokekko poumensis</i>	CAS 231861	Sommet Poum
<i>Dierokekko nehoueensis</i>	AMS R 161242	Dôme de Tiébaghi
<i>Dierokekko nehoueensis</i>	AMS R 166970	Rivière Néhoué
<i>Dierokekko nehoueensis</i>	CAS 231855	Rivière Néhoué
<i>Dierokekko inexpectatus</i>	MNHN 2004.0025	Sommet Poum
<i>Dierokekko validiclavis</i>	AMS R 149305	Mt. Panié
<i>Dierokekko validiclavis</i>	AMS R 144230	Mt. Panié
<i>Dierokekko validiclavis</i>	AMS R 153696	Mt. Mandjélia
<i>Dierokekko validiclavis</i>	AMS R 153695	Mt. Mandjélia
<i>Dierokekko koniambo</i>	CAS 231873	Mt. Koniambo
<i>Dierokekko thomaswhitei</i>	AMS R 161153	Mt. Taom
<i>Dierokekko thomaswhitei</i>	CAS 231876	Mt. Taom
<i>Dierokekko kaalaensis</i>	CAS 231872	Piton de Pandop
<i>Dierokekko kaalaensis</i>	CAS 231870	Kaala
<i>Dierokekko kaalaensis</i>	MNHN 2004.0017	Kaala
<i>Dierokekko insularis</i>	CAS 231857	Île Yandé
<i>Dierokekko insularis</i>	AMS R 166972	Île Yandé
<i>Dierokekko insularis</i>	CAS 231858	Île Yandé
<i>Dierokekko insularis</i>	AMS R 166974	Île Yandé
<i>Dierokekko insularis</i>	AMS R 161070	Île Art
<i>Dierokekko insularis</i>	MNHN 2003.0020	Île Art
<i>Dierokekko insularis</i>	CAS 231865	Île Pott
<i>Dierokekko insularis</i>	AMS R 161067	Île Pott
<i>Oedodera marmorata</i>	AMS R 161254	Creek à Paul, Sommet Noir, Paagoumène
<i>Pseudothecadactylus lindneri</i>	AMS R 90195	Liverpool River, Northern Territory, Australia

TABLE 3. Mensural data for the types of *Dierogekko koniambo*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	MNHN 2004.0016	AMS R 161114	AMS R 161130	AMS R 161131	CAS 231873	CAS 231874	CAS 231875
	Holotype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype
Sex	male	male	male	female	female	male	male
SVL	42.6	43.0	41.8	42.2	41.9	40.9	43.0
ForeaL	4.8	5.2	5.4	5.2	5.1	5.2	4.9
CrusL	6.2	5.8	5.5	5.9	6.0	5.9	5.8
TailL	40.8	31.1	33.0	33.6	35.3	4.0	42.8
(regen.)	23.5	28.1	29.8	31.0	31.9	broken	27.2
TailW	5.0	5.4	4.2	5.3	5.5	N/A	4.4
TrunkL	18.1	19.1	16.2	18.6	18.8	19.0	18.7
HeadL	12.2	11.3	11.2	12.1	11.0	11.2	11.2
HeadW	7.2	7.9	7.4	7.6	7.4	7.4	7.2
HeadH	5.0	4.2	4.2	4.2	5.0	4.5	4.1
OrbD	3.1	2.8	2.8	2.7	2.8	3.0	2.8
EyeEar	3.2	3.1	3.0	3.0	2.7	2.8	2.4
SnEye	4.8	4.6	4.4	4.1	4.4	4.4	4.3
NarEye	3.0	2.8	3.0	2.6	2.7	3.1	2.6
Interorb	4.2	4.1	3.8	4.0	3.8	4.0	3.7
EarL	1.5	1.4	1.4	1.3	1.3	1.3	1.5
Internar	1.7	1.8	1.5	1.5	1.7	1.6	1.9

TABLE 4. Mensural data for the types of *Dierogekko kaalaensis*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	MNHN 2004.0017	AMS R 161097	AMS R 161098	CAS 231870	CAS 231871	CAS 231872
	Holotype	Paratype	Paratype	Paratype	Paratype	Paratype
Sex	male	female	male	male	female	female
SVL	42.2	45.4	42.0	41.7	33.4	40.7
ForeaL	5.4	5.3	4.8	5.1	4.3	5.0
CrusL	6.4	6.1	5.9	6.1	5.1	5.8
TailL	41.8	42.6	45.5	49.0	30.0	38.6
(regen.)	30.4	31.3	24.4	12.9	22.8	10.3
TailW	5.4	5.5	4.1	4.4	3.4	4.8
TrunkL	15.9	18.2	14.8	16.7	14.0	16.2
HeadL	11.6	11.9	12.2	12.7	10.8	11.7
HeadW	8.1	8.0	7.8	7.8	6.5	7.6
HeadH	4.0	4.3	4.5	4.1	3.5	3.9
OrbD	2.6	3.1	3.2	2.7	2.5	3.0
EyeEar	3.0	2.9	2.6	2.9	2.8	2.6
SnEye	4.3	4.3	4.3	4.3	3.8	4.2
NarEye	2.9	3.0	2.6	3.0	2.5	2.8
Interorb	3.8	3.8	3.4	3.7	3.4	4.0
EarL	1.6	1.3	1.5	1.5	1.4	1.4
Internar	1.4	1.3	1.5	1.6	1.3	1.2

TABLE 5. Mensural data for the types of *Dierogekko thomaswhitei*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	MNHN 2004.0018	AMS R 166975	AMS R 161153	AMS R 161178	AMS R 161180	CAS 231837	CAS 231838	CAS 231876	CAS 231877
	holotype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype
Sex	male	male	male	male	female	male	juv. female	female	male
SVL	41.7	40.8	41.9	42.6	44.9	38.3	33.6	43.6	43.4
ForeaL	5.4	4.8	5.6	5.4	5.6	4.8	4.4	5.3	4.9
CrusL	5.8	6.0	6.4	6.4	6.3	5.4	5.0	6.1	5.6
TailL	39.0	19.0	33.2	37.7	38.4	45.4	34.4	38.7	39.3
(regen.)	23.4	broken	19.6	32.1	33.5	14.8	6.4	27.3	27.3
TailW	4.0	4.4	5.1	4.8	5.2	4.0	3.3	5.0	4.9
TrunkL	15.8	17.3	18.5	18.8	18.6	15.7	13.9	18.4	17.7
HeadL	12.6	11.0	12.0	12.0	12.5	11.7	9.5	11.5	11.9
HeadW	8.0	7.3	7.5	7.1	8.0	6.9	6.1	7.3	7.2
HeadH	4.8	4.7	4.8	5.1	5.9	4.8	3.8	4.7	4.5
OrbD	2.8	2.8	2.8	2.5	3.2	2.5	2.2	3.0	2.9
EyeEar	3.0	3.0	2.6	3.0	3.0	3.0	2.7	2.7	2.6
SnEye	4.2	4.3	4.6	4.7	4.8	3.8	3.6	4.6	4.5
NarEye	2.9	2.7	2.8	3.2	2.9	2.6	2.5	2.9	3.0
Interorb	3.6	3.5	3.8	3.6	3.6	3.1	2.8	3.9	3.7
EarL	1.6	1.4	2.0	1.9	2.2	1.2	1.8	1.7	1.8
Internar	1.5	1.5	1.6	1.4	1.6	1.2	1.1	1.4	1.3

TABLE 6. Mensural data for the types of *Dierogekko nehoueensis*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	MNHN 2004.0019	AMS R 161242	AMS R 161243	AMS R 161244	AMS R 166976	CAS 231837	CAS 231838	CAS 231855	CAS 231863	CAS 231864
	holotype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype
Sex	male	female	female	female	female	female	male	female	male	female
SVL	40.3	39.9	39.4	35.1	40.0	38.1	40.2	32.4	38.5	36.0
ForeaL	5.3	4.9	5.3	4.8	5.1	5.3	4.6	4.5	4.8	4.7
CrusL	6.1	6.0	6.0	5.1	6.3	6.0	5.6	4.7	5.5	5.6
TailL	36.2	29.5	5.5	37.2	40.0	43.4	42.7	37.6	37.8	31.1
(regen.)	32.1	27.2	broken	17.8	14.9	N/A	N/A	11.4	28.2	21.4
TailW	4.7	4.9	N/A	4.0	3.7	3.4	4.4	4.1	4.4	3.7
TrunkL	17.4	15.8	15.7	14.5	17.4	15.4	15.2	13.8	17.2	16.7
HeadL	12.5	11.6	10.6	10.4	11.6	10.1	12.1	9.8	11.8	10.0
HeadW	7.3	6.7	6.4	5.6	6.7	6.1	7.3	6.2	7.3	6.0
HeadH	5.0	4.9	4.7	3.6	4.4	4.6	4.5	4.3	4.5	4.7
OrbD	2.7	2.8	2.6	2.5	2.6	2.5	2.6	2.2	2.7	2.7
EyeEar	3.2	2.8	2.5	2.4	3.1	2.8	3.4	2.5	2.5	2.6
SnEye	4.2	4.1	3.9	3.5	4.2	3.9	4.1	3.6	4.2	3.7
NarEye	3.3	2.7	2.7	2.5	3.2	2.6	2.8	2.4	2.8	2.5
Interorb	4.0	3.7	3.2	3.5	3.1	3.0	3.5	3.0	3.5	3.3
EarL	1.2	1.5	1.4	1.4	1.5	1.1	1.3	1.2	1.4	1.3
Internar	1.3	1.7	1.1	1.2	1.4	1.3	1.4	1.3	1.6	1.6

TABLE 7. Mensural data for the types of *Dierogekko insularis*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	MNHN 2004.0020	AMS R 161067	AMS R 161073	AMS R 161075	AMS R 166971	CAS 231858	CAS 231859	CAS 231865	CAS 231867	CAS 231868
	holotype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype
Sex	male	male	male	male	female	male	female	male	male	male
SVL	41.4	37.3	40.0	39.3	39.9	36.7	35.3	38.6	37.3	37.3
ForeaL	5.5	4.9	4.8	4.6	4.3	4.4	4.0	4.7	4.9	4.7
CrusL	5.8	5.4	5.3	5.7	5.4	5.2	4.9	5.8	5.8	5.3
TailL	49.6	36.9	23.8	34.6	29.0	33.5	11.6	30.1	35.8	38.6
(regen.)	19.8	18.0	21.5	31.0	broken	17.6	broken	3.6	24.4	16.6
TailW	4.7	4.4	3.6	4.9	N/A	4.5	4.7	4.4	4.6	4.3
TrunkL	16.5	15.7	14.9	18.7	17.4	14.8	15.2	16.1	14.8	13.2
HeadL	11.1	10.4	11.0	10.6	11.7	10.5	9.8	10.4	10.8	10.3
HeadW	7.7	6.6	7.2	7.2	6.4	7.3	6.3	6.4	7.1	7.0
HeadH	4.5	4.2	4.9	4.9	4.1	4.1	4.1	4.9	4.7	5.0
OrbD	3.0	2.6	2.9	2.8	2.7	2.6	2.5	2.9	2.7	2.6
EyeEar	3.0	3.0	3.2	3.1	3.0	2.8	2.8	2.8	2.9	2.6
SnEye	4.7	3.9	4.2	4.3	3.8	3.8	3.5	4.0	4.0	4.4
NarEye	3.0	2.4	2.9	2.7	2.6	2.8	2.2	2.4	2.5	2.4
Interorb	4.1	3.2	3.7	3.9	3.1	3.7	3.5	3.6	3.9	2.8
EarL	1.6	1.2	1.2	1.3	0.9	1.5	1.3	1.1	1.5	1.5
Internar	1.5	1.6	1.5	1.6	1.2	1.4	1.4	1.4	1.4	1.3

TABLE 8. Mensural data for the types of *Dierogekko poumensis*, sp. nov. and *D. inexpectatus*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	<i>poumensis</i>										<i>inexpectatus</i>
	MNHN 2004.0021	AMS R 166977	AMS R 166978	AMS R 166979	AMS R 166980	CAS 231839	CAS 231841	CAS 231850	CAS 231851	CAS 231852	MNHN 2004.0025
	holotype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	paratype	holotype
Sex	male	male	male	female	female	female	male	male	female	male	female
SVL	34.3	35.0	36.2	35.6	34.7	35.7	38.3	34.6	34.6	36.5	39.5
ForeaL	4.4	4.1	4.4	4.5	4.7	4.3	4.7	4.7	4.8	4.4	4.9
CrusL	5.4	5.0	5.4	5.5	5.1	5.1	5.3	5.3	5.0	5.4	5.7
TailL	35.3	32.0	38.4	35.4	32.2	32.2	16.6	37.1	32.2	30.8	36.2
(regen.)	28.1	14.2	14.1	7.7	10.2	17.2	broken	10.3	5.7	20.3	25.8
TailW	5.2	4.8	4.5	5.0	5.0	5.0	5.1	5.2	5.0	4.8	4.8
TrunkL	14.0	13.5	13.2	13.4	13.6	14.2	16.9	14.5	13.7	14.9	17.4
HeadL	10.5	11.3	10.9	9.7	10.7	9.1	10.7	9.4	10.2	9.7	10.5
HeadW	6.9	6.6	6.3	6.5	6.1	6.0	6.8	6.4	6.8	6.7	7.2
HeadH	4.4	4.4	4.4	3.9	4.2	3.4	3.9	4.4	3.6	4.4	4.1
OrbD	2.4	2.6	2.6	2.5	2.3	2.3	2.5	2.4	2.2	2.7	2.5
EyeEar	2.8	3.1	2.6	2.6	2.8	3.3	2.8	2.9	2.3	2.6	3.0
SnEye	3.7	3.5	4.0	3.5	3.3	3.6	3.4	3.7	3.3	3.5	4.6
NarEye	2.4	2.5	2.4	2.1	2.3	2.4	2.5	2.3	2.2	2.4	3.0
Interorb	3.2	3.1	3.1	3.2	2.9	2.9	3.4	3.4	3.1	2.8	3.5
EarL	1.2	0.9	1.0	1.0	1.0	1.0	1.1	1.4	1.1	1.1	1.4
Internar	1.2	1.1	1.1	1.4	1.1	1.2	1.1	1.2	1.3	1.5	1.3